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Performance of Steel Products Coated with Zinc and Zinc Alloys in Pressure Treated Wood

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Performance of Steel Products Coated with Zinc and Zinc Alloys in Pressure Treated Wood

RESEARCH REPORT RP07-1

2007



American Iron and Steel Institute



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PREFACE

This project is part of an ongoing investigation to establish reliable life prediction data for galvanized steel products used with currently available pressure treated woods and to explore ways of making this environment less hostile. This report provides helpful insight on testing methodologies and useful data for researchers and product manufacturers that are relatively familiar with the details of this technical issue.

It is expected that work in this area will continue under the overall leadership and direction of the International Lead Zinc Research Organization.

Research Team
Steel Framing Alliance

ILZRO ZC-26

PERFORMANCE OF STEEL PRODUCTS COATED WITH ZINC AND ZINC ALLOYS IN PRESSURE TREATED WOOD

PREPARED FOR

**INTERNATIONAL LEAD ZINC RESEARCH ORGANIZATION
(ILZRO)**

**2525 MERIDIAN PARKWAY, SUITE 100
DURHAM, NC**

BY

**NAHB RESEARCH CENTER, INC.
UPPER MARLBORO, MD**

NOVEMBER 2006

About the NAHB Research Center



The NAHB Research Center, located in Upper Marlboro, Md., is known as America's Housing Technology and Information Resource. In its nearly 40 years of service to the home building industry, the Research Center has provided product research and building process improvements that have been widely adopted by home builders throughout the United States. The Research Center carries out extensive programs of information dissemination and interchange among members of the home building industry and between the industry and the public.

About ILZRO



The International Lead Zinc Research Organization, Inc. was formed in 1958 as a non-profit research foundation. Silver was added to its core group of research metals in 2002 with the launching of the Silver Research Consortium. ILZRO's sponsors include most of the major producers of lead, zinc and silver, and significant numbers of end-users of these metals from among the steel, automotive, die casting, battery, galvanizing and other industries. ILZRO's R&D encompasses the primary applications of lead, zinc and silver, as well as significant work in the areas of the environment and human health. The results of ILZRO R&D efforts are communicated through a variety of forums, including research reports, technical seminars, expert consulting, internet sites and printed publications.

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ZC-26 - Steering Committee

Graeme Anderson	Teck Cominco Metals, Ltd
Ken DeSouza	Dofasco
Prentiss Douglass	Simpson Strong Tie
Nader Elhajj	NAHB Research Center
Margie Farabaugh	The Techs
Frank Goodwin	International Lead Zinc Research Organization (ILZRO)
Bill Hornfeck	The Techs
Tom Langill	American Galvanizers Association (AGA)
Jay Larson	American Iron and Steel Institute (AISI)
Matthew McCosby	U.S. Steel
Doug Rourke	International Lead Zinc Research Organization (ILZRO)
Phil Schneider	Arch Wood Protection
Larry Williams	Steel Framing Alliance

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1.0 BACKGROUND

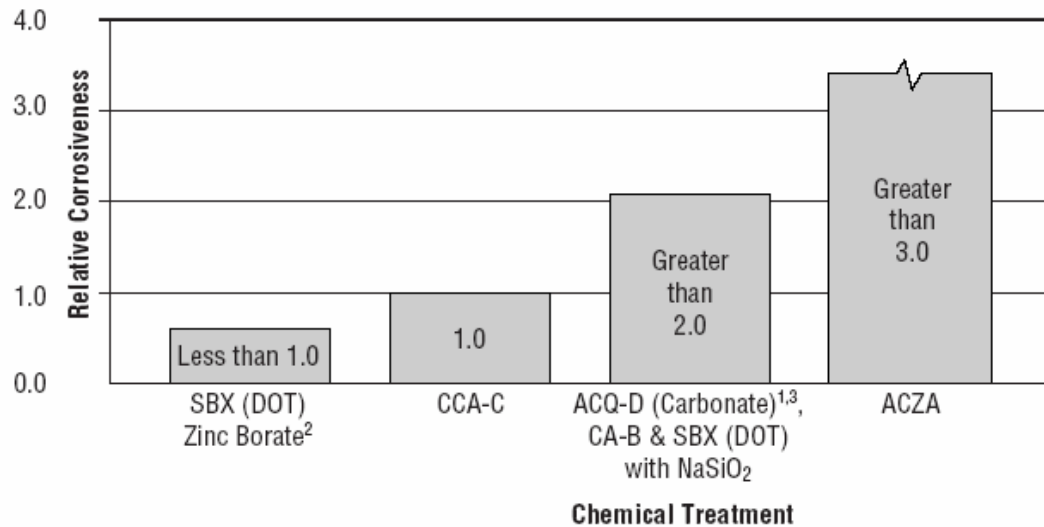
Wood products are usually treated with fungicide like chromate copper arsenate (CCA), Creosote, and Pentachlorophenol to fight decay and increase product life span. Moisture and temperature, which vary greatly with local conditions, are the principal factors that affect the rate of wood decay. In the presence of moisture, metals used for fasteners (nails, screws, etc.) may corrode when in contact with wood treated with certain preservative or fire-retardant salts. The decay resistance of hardwood is greatly affected by differences in the preservative qualities of the wood extractives, the attacking fungus, and the conditions of exposure.

The use of chromate copper arsenate (CCA) treatment has been phased out in most residential applications as of December 2003 in the US. This was a voluntary action by the wood preservative industry. There are a number of alternative treatments to CCA ranging from azoles to borates, such as copper azoles (CA), arcylated copper quaternary (ACQ), sodium borate (SB), and ammoniacal copper zinc arsenate (ACZA). Copper content has increased significantly in some treatments and high corrosion rates of galvanized steel connectors and fasteners have been reported. Initial studies on the corrosivity of alternative treatments reported high corrosion rates of galvanized fasteners with some treatments and recommended stainless steel products or steel with thicker zinc coating. Home improvement centers in some markets had already pulled out galvanized fasteners and replaced them with ceramic-coated fasteners that cost approximately twice that of galvanized fasteners.

There aren't many studies done on the performance of metals in alternative treatments to CCA. Figure 1 below shows Simpson Strong-Tie¹ test results of the relative corrosivity of galvanized metals in wood samples treated with different preservatives including CCA (as baseline), ACQ and SB according to AWPA² E 12-94 Standard (Tests carried out by Simpson Strong-Tie Co.).

¹ Simpson Strong-Tie, Inc. Technical Bulletin "Preservative Treated Wood". Dublin CA. 2004.
<http://www.strongtie.com/ftp/bulletins/T-PTWOOD05.pdf>.

² American Wood Preservers' Association, P.O. Box 388, Selma, AL 36702-0388, USA. www.awpa.com.



Notes:

1. The relative corrosion rates of ACQ-D (Carbonate) and CA-B treated wood on hot-dip galvanized steel were grouped and analyzed together.
2. Zinc Borate is a preservative treatment for wood composites.
3. All testing was performed on woods with retention levels at Ground Contact - or below (0.40 pcf for ACQ; 0.21 pcf for CA-B)

Figure 1 – Relative corrosivity of treatments compared to CCA using G90 and G185 continuous Hot-Dipped Galvanized steel samples (AWPA E12 tests)

2.0 OBJECTIVE

This research project has the following objectives:

- Develop a test protocol to evaluate the performance of zinc-coated fasteners and sheet steel in wood specimens treated with CCA, CA, ACQ and untreated wood.
- Conduct long-term corrosion tests for zinc-coated fasteners (nails and screws) in wood specimens treated with CCA, CA, ACQ and untreated wood.
- Conduct long-term corrosion tests of zinc-coated and Galvalume steel coupons (heavy and light gauge) in wood specimens treated with CCA, CA, ACQ and untreated wood.

3.0 TEST METHOD

3.1 Available Test Methods

The most common and widely available accelerated tests to evaluate the corrosion of fasteners and sheet steels in pressure treated wood are:

1. American Wood-Preservers' Association Standard E12-94 *"Standard Method of Determining Corrosion of Metal in Contact With Treated Wood."*

2. ASTM B117-03³ “Standard Practice for Operating Salt Spray (Fog) Apparatus.”

The AWWA E12 test method was promulgated to enable the user to determine corrosion rates of treated wood for a specific set of metals. It, however, was not originally designed to test specific types of fasteners. The test method currently does not provide meaningful data to users and specifiers of treated wood.

As with AWWA E12, there are several concerns with ASTM B117 salt spray test when trying to rank the corrosion performance of fasteners and connectors. The reason that the ASTM B117 test methods do not accurately reproduce corrosion performance for fasteners and connectors is that they do not accurately reproduce the conditions in which these components are installed. For one thing, fasteners and connectors tested in a salt-spray cabinet are continuously wet, while those components on a structures experience periods of wetness and dryness.

Another difference between the conditions in a salt spray test and real-world conditions is the salt concentration. Salt spray tests use solutions with a very high salt concentration (as high as 5%) that is much higher than concentrations found in the real world.

Currently, the AWWA, International Staple, Nail, and Tool Association (ISANTA), the American Galvanizers Association (AGA), and the International Lead Zinc Research Organization (ILZRO) are all actively working to develop an improved consensus standard that will give better real life predictability to these tests and result in better use recommendations.

3.2 Recommended Test Method

In the absence of an improved consensus standard, the following test method was recommended by the project steering committee to be used for testing the fasteners and sheet steel specimens for this project:

- Prepare specimens and place in environmental chamber with the following conditions:
 - Temperature $49^{\circ}\text{C} \pm 1^{\circ}\text{C}$ (120°F)
 - Relative Humidity 90% ($\pm 1\%$)

³ ASTM B117-03 “Standard Practice for Operating Salt Spray (Fog) Apparatus.” American Society of Testing and Materials (ASTM). West Conshohocken, PA.

- Water spray specimens with de-ionized water in the chamber daily for 15-30 minutes
- Keep steel specimens in the chamber for 30 days, 60 days, and 180 days.
- Keep fastener specimens in the chamber for 15 days, 30 days, and 90 days.

4.0 MATERIALS

4.1 Wood Specimens

Wood blocks used for testing were treated with different treatments (i.e., preservative) as shown in Table 1. All wood specimens were received in dry condition. Table 2 shows the results from the actives analyses for the different treatments used in Table 1. These are in pounds of active per cubic foot of wood. Preservative retention in the wood is commercially determined by multiplying the percent of analyte by the average density of oven dry wood. In the case of southern pine, the industry accepted value is 32 pounds of wood per cubic foot of wood (513 Kg/m³).

Table 1 – Wood Specimens Used for Testing

Wood Species	Treatment	Retention
Southern Yellow Pine (SYP)	Chromated Copper Arsenate (CCA)	0.4 lb/ft ³
	Copper Azoles (CA-B)	0.2 lb/ft ³
	Alkaline Copper Quaternary Ammonium Compound (ACQ)	0.4 lb/ft ³
Spruce Pine Fir (SPF)	Un-treated (UN)	0
For SI: 1 lb/ft ³ (pcf) = 16 Kg/m ³		

Table 2 – Analysis of Actives in Wood Samples (pcf Based on Wood Density of 32 pcf)

Preservative	CuO	Cr O ₃	As ₂ O ₅	Cu	Teb or Quart	Total Cu	Total Actives
CCA	0.083	0.193	0.138	NA ¹	NA ¹	0.066	0.414
CA-B	NA ¹	NA ¹	NA ¹	0.211	0.0074	0.211	0.219
ACQ Type D w/carboquat	0.237	NA ¹	NA ¹	NA ¹	0.0979	0.189	0.335

For SI: 1 lb/ft³ (pcf) = 16 Kg/m³

¹ N/A = Not applicable analyte.

4.2 Sheet Steel Specimens

Steel specimens used for testing represented a variety of thicknesses and coating types as shown in Table 2a.

The regular galvanized sheet coatings (G60, G90, and G185) had a small amount (about 0.18-0.25%) Aluminum added to the zinc per normal industrial practice. The Galvalume (AZ) coatings were nominally 55% Aluminum, 1.6% Silicon, and 43.4% Zinc (Zn). The chrome (Cr) layer on AZ is lighter than on Zn because of the different reactivity of these coatings with Cr.

All sheet steel samples were with sheared, unprotected edges.

4.3 Fastener Specimens

Fasteners used for testing represented two different fastener types (nails and screws) with two different coating each as shown in Table 3.

Table 3 – Sheet Steel and Fastener Specimens Used for Testing

Sheet Steel Specimens			Fastener Specimens
Steel Type	Coating	Coating Weight	
Chromated Galvanized	G60	0.6 oz/ft ² (a)(b)	Hot Galvanized Nails HD Galvanized Screws (Maze S263) Hot Galvanized Screws
	G90	0.9 oz/ft ² (a)(b)	
	G185	0.185 oz/ft ² (a)(b)	
Galvanized plus Acrylic	G90	0.9 oz/ft ² (a)	
Chromated Galvalume	AZ50	10 to 20 mg/m ² of Acrylic per side	
Galvalume plus Acrylic	AZ55	15 mg/m ²	
For SI: 1 oz/ft ² = 304 g/m ² ^a Weight on both sides ^b 10 to 20 mg/m ² of Acrylic per side			

5.0 TEST SPECIMENS

Tables 4 and 5 show the test matrix for sheet steel and fasteners that were tested in this research project, respectively.

Table 4 – Sheet Steel Test Matrix

Specimen Type	Steel Type	Coating	Treated Wood	No. of Tests		
				First Pull	Second Pull	Final Pull
Heavy Gauge Sheet Steel 16 Gauge (54 Mil)	Chromated Galvanized	G60	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Chromated Galvanized	G185	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Chromated Galvalume	AZ 50	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Galvalume plus Acrylic	AZ 55	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
Light Gauge Sheet Steel 20, 23, and 27 Gauge (33, 24, 14 Mil)	Chromated Galvanized	G90 LG	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Galvanized plus Acrylic	G90 LG	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Chromated Galvalume	AZ 50 LG	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3
	Galvalume plus Acrylic	AZ 55 LG	CCA	3	3	3
			ACQ	3	3	3
			CA	3	3	3
			Untreated	3	3	3

For SI: 1 mil = 0.0254 mm

Table 5 – Fastener Test Matrix^{1,2}

Specimen Type	Coating	Fastener Brand	Fastener Size ¹	Wood Treatment	No. of Tests		
					First Pull	Second Pull	Final Pull
Nails	HD Galvanized	Maze S263	8d x 1.5"	CCA	3	3	3
	Hot Galvanized			CCA	3	3	3
	HD Galvanized	Maze S263		ACQ	3	3	3
	Hot Galvanized			ACQ	3	3	3
	HD Galvanized	Maze S263		CA	3	3	3
	Hot Galvanized			CA	3	3	3
	HD Galvanized	Maze S263		Untreated	3	3	3
	Hot Galvanized			Untreated	3	3	3
Screws	HD Galvanized	Zinclad	#10x1.5"	CCA	3	3	3
	Hot Galvanized			CCA	3	3	3
	HD Galvanized	Zinclad		ACQ	3	3	3
	Hot galvanized			ACQ	3	3	3
	HD Galvanized	Zinclad		CA	3	3	3
	Hot galvanized			CA	3	3	3
	HD Galvanized	Zinclad		Untreated	3	3	3
	Hot galvanized			Untreated	3	3	3

For SI: 1 inch = 25.4 mm

¹ Fasteners are spaced at a minimum of 10 times the diameter of the fastener.

² All fasteners were galvanized.

6.0 SPECIMEN PREPARATION AND TEST PROCESS

The following describes specimen preparation and testing processes.

6.1 Sheet Steel Specimens (see photos 1 through 16 in Appendix A).

- Sheet steel samples were cut into rectangles 1-1/2" wide by 4" long (12.7 x 102 mm).
- Each sheet steel specimen was properly labeled (i.e., coating type)
- All wood blocks were lightly sanded to ensure a smooth surface.
- Each steel sample was pre-drilled two 3/16" (4.77 mm) diameter holes, one close to each end.
- Each steel sample was placed on top of a wood block and fastened with two nail through the pre-drilled holes.
- A hammer with rubber head was used to drive the nails through the wood blocks.

- g. Nails used were J-148 Hanger Nails (1-1/2" long, D = 0.156") for the 16 gauge steel, and MAZE S263 for the thinner gauge steel. All fasteners used were galvanized.
- h. The wood block can be as long and as wide as needed.
- i. The prepared samples were placed in the environmental chamber.
- j. Steel samples were tested as described in Section 3.2.
- k. First pull was after 30 days. Second pull was after 60 days. Final pull was after 180 days.
- l. Each Pull:
 - i. Three (3) specimens from each type of wood treatment and each coating type were retrieved from the chamber.
 - ii. The wood block was carefully split to retrieve the specimen without damaging the specimen.
 - iii. Steel specimens were weighed as they come out of the wood block.
 - iv. The retrieved specimens were cleaned as described in Section 7.0.

6.2 Fastener Specimens

- a. Treated and un-treated wood were conditioned in the environmental chamber for 30 days under the same conditions as described in the recommended test method in Section 3.2.
- b. Each fastener was weighed before being driven into the wood block.
- c. The diameter of each fastener is measured before being driven into the wood block.
- d. The same number and type of fasteners are weighed and set aside outside the chamber as the ones driven in wood blocks.
- e. A hammer with rubber head is used to drive nails through wood. No pre-drilling was used in the wood blocks.
- f. Fasteners were spaced at 10d apart (about 1-1/2") (38 mm).
- g. Wood blocks were of slightly different dimensions.
- h. Prepared samples are placed in the environmental chamber.
- i. Fastener samples were tested as described in Section 3.2.
- j. First pull was after 15 days. Second pull was after 30 days. Final pull was after 90 days.
- k. Each Pull:
 - i. Three (3) fasteners from each type of wood treatment and for each type of fastener were removed from the chamber.
 - ii. The wood block was carefully split to retrieve the fasteners without damaging the fastener or the fastener head.
 - iii. Each retrieved fastener was weighed as it came out of the wood block.

- iv. An exact number and type of fasteners was taken from the untested ones (outside the chamber).
- v. The retrieved specimens were cleaned as described in Section 7.2.

7.0 CLEANING PROTOCOL

Different cleaning methods were used for the steel and the fastener specimens as described in Sections 7.1 and 7.2.

7.1 Sheet Steel Specimens

Sheet steel specimens were cleaned in two stages:

Stage 1: Mechanical cleaning that consisted of lightly brushing the corrosion byproducts of the specimen

Stage 2: Chemical cleaning as described below:

- a. 8.5% concentrated HCL solution (1.5 specific gravity)
- b. Solution kept at ambient temperature.
- c. Steel specimens were dipped in solution for 15 seconds, repeated six times.
- d. Steel specimens were dried.
- e. Steel specimens were weighed immediately after they were out of the solution and dried.

7.2 Fastener Specimens

Fastener coatings were chemically stripped (corroded, tested, and un-corroded, untested, ones) using the following steps:

- a. A beaker of sufficient size was used with some room left at top as some foaming could occur
- b. Beaker was set in a shallow Pyrex dish with some water in case foam overflows the beaker.
- c. Approximately 30-50% HCl acid was mixed with distilled or de-ionized water (50% of 36% HCl = ~16% acid)
- d. Acid was always added to water, not water to acid (solution gets warm as acid mixes)
- e. 1% inhibitor was used, 10mL /Liter of Acid solution
- f. Specimens were dipped in 50% HCL solution mixed with 3% inhibitors.
- g. De-ionized water was used to make the solution
- h. Solution kept at ambient temperature
- i. Fasteners were dipped in solution for 3 minutes.
- j. Fasteners were rinsed with water immediately after removing from solution

- k. Fasteners were dried
- l. Fasteners were weighed immediately after they are out of the solution and dried
- m. The diameter of each cleaned fastener is measured and recorded

8.0 RETREIVALS

8.1 Sheet Steel Specimens

Four different types of sheet steel (Chromated Galvanized, Galvanized plus Acrylic, Chromated Galvalume, and Galvalume plus Acrylic) were tested for 30-, 60-, and 180-days. Photos of selected specimens after retrieval are shown in photos 17 through 28 of Appendix A.

8.1.1 30-Day Retrievals

A total of ninety-six (96) samples were retrieved after 30 days of being placed inside the chamber. List of the retrieved specimens is shown in Table 6. Three samples for each coating/ treatment were retrieved. The specimens were kept in the chamber for a total of 768 hours. The final weight and the weight loss of each of the retrieved specimens are shown in Tables B1 and B2 (Appendix B). Concerns about the adequacy of the coating thickness were raised for the G60 galvanized samples. These samples were discarded after the 30-day pull and new samples were made and placed in the chamber in December 2005. Results of the new G60 samples 30-day retrieval are shown in Table B3.

8.1.2 60-Day Retrievals

A total of ninety six (96) samples were retrieved after 60 days of being inside the chamber. Summary of the retrieved samples is shown in Table 6. Three samples for each coating/ treatment were retrieved. The specimens were kept in the chamber for a total of 1512 hours. The final weights and the weight loss of the retrieved samples are shown in Tables B4, B5, and B6.

8.1.3 180-Day Retrievals

A total of ninety six (96) samples were retrieved after 180days of being inside the chamber. Summary of the retrieved samples is shown in Table 6. Three samples for each coating/ treatment were retrieved. The specimens were kept in the chamber for a total of 4,440 hours. The final weights and the weight loss of the retrieved samples are shown in Tables B7, B8, and B9.

Table 6 – 30-, 60-, and 180-Day Retrieval Summary

Steel Type	Coating	Treated Wood	Date Placed in Chamber	Date 30-Day Pull	Date 60-Day Pull	Date 180-Day Pull
Galvanized	G60	CCA	8/22/2005	9/23/2005	-	-
		CA				
		ACQ				
		UN				
Galvanized	G185	CCA	8/22/2005	9/23/2005	10/24/2005	2/23/06
		CA				
		ACQ				
		UN				
Galvanized (New)	G60-N	CCA	12/21/2005	1/22/2006	2/23/2006	6/26/06
		CA				
		ACQ				
		UN				
Chromated Galvalume	AZ50	CCA	8/22/2005	9/23/2005	10/24/2005	2/23/06
		CA				
		ACQ				
		UN				
Galvalume + Acrylic	AZ55	CCA	8/22/2005	9/23/2005	10/24/2005	2/23/06
		CA				
		ACQ				
		UN				
Galvanized (Light Gauge)	G90 LG	CCA	8/22/2005	9/23/2005	10/24/2005	2/23/06
		CA				
		ACQ				
		UN				
Galvanized + Acrylic (Light Gauge)	G90 LG	CCA	9/23/2005	10/24/2005	11/23/2005	3/27/06
		CA				
		ACQ				
		UN				
Chromated Galvalume (Light Gauge)	AZ50 LG	CCA	9/23/2005	10/24/2005	11/23/2005	3/27/06
		CA				
		ACQ				
		UN				
Galvalume + Acrylic (Light Gauge)	AZ55 LG	CCA	9/23/2005	10/24/2005	11/23/2005	3/27/06
		CA				
		ACQ				
		UN				

8.2 Fastener Specimens

Two nail types and two screw types were tested for 15-, 30-, and 90-days. Photos of selected specimens after retrieval are shown in photos 29 through 47 of Appendix A.

8.2.1 15-Day Retrievals

A total of forty eight (48) fastener specimens were retrieved after 15 days of being inside the chamber. Summary of the retrieved samples is shown in Table 7. The specimens were kept in the chamber for a total of 360 hours. A similar number of nails and screws (total of 48) were kept outside the chamber. These specimens were cleaned and weighted as described in Section 7. Weight loss and change in diameter for the tested specimens are shown in Tables B10 and B11. Results of the un-tested specimens (outside chamber) are shown in Tables B12 and B13.

8.2.2 30-Day Retrievals

A total of forty eight (48) fastener samples were retrieved after 30 days of being inside the chamber. Summary of the retrieved samples is shown in Table 7. The specimens were kept in the chamber for a total of 744 hours. A similar number of nails and screws (total of 48) were kept outside the chamber. These specimens were cleaned and weighted as described in Section 7. Weight loss and change in diameter for the tested specimens are shown in Tables B14 and B15. Results of the un-tested specimens (outside chamber) are shown in Tables B16 and B17.

8.2.3 90-Day Retrievals

A total of forty eight (48) fastener samples were retrieved after 90 days of being inside the chamber. Summary of the retrieved samples is shown in Table 7. The specimens were kept in the chamber for a total of 2136 hours. A similar number of nails and screws (total of 48) were kept outside the chamber. These specimens were cleaned and weighted as described in Section 7. Weight loss and change in diameter for the tested specimens are shown in Tables B18 and B19. Results of the un-tested specimens (outside chamber) are shown in Tables B120 and B121.

Table 7 – 15-, 30-, and 90-Day Fastener Retrieval Summary

Fastener Type	Fastener Type	Treated Wood	Date Placed in Chamber	Date of 15-Day Pull	Date of 30-Day Pull	Date of 90-Day Pull
Zinclad	#8x 1.5" Screw	CCA	02/24/2006 & 03/01/2006	03/16/2006	04/01/2006	05/24/2006
		CA				
		ACQ				
		UN				
8d Nail	#8x 1.5" Screw	CCA	02/24/2006 & 03/01/2006	03/16/2006	04/01/2006	05/24/2006
		CA				
		ACQ				
		UN				
Maze S263	8dx1.5" Nail	CCA	02/24/2006 & 03/01/2006	03/16/2006	04/01/2006	05/24/2006
		CA				
		ACQ				
		UN				
8d Nail	8dx1.5" Nail	CCA	02/24/2006 & 03/01/2006	03/16/2006	04/01/2006	05/24/2006
		CA				
		ACQ				
		UN				

9.0 RESULTS

9.1 Sheet Steel

Table 8 shows the average mass loss, in grams, for the retrieved sheet steel specimens for the 30-day, 60-day, and 180-day retrievals in the different wood treatments. Figures 2 through 5 show the average weight loss by coating type and by treatment type for both heavy gauge and light gauge specimens.

Table 8 – Average Sheet Steel Weight Loss

Specimen Type	Steel Type	Coating	Treated Wood	Average Weight Loss (grams)		
				30-Day	60-Day	180-Day
Heavy Gauge Sheet Steel	Chromated Galvanized	G60-N	CCA	0.4008	0.4881	0.6093
			ACQ	0.6419	0.6547	0.8577
			CA	0.4873	0.4972	0.7145
			Untreated	0.2311	0.2410	0.2850
	Chromated Galvanized	G185	CCA	1.2675	0.8383	1.4365
			ACQ	2.7325	2.4797	2.9266
			CA	1.1591	1.3814	1.6029
			Untreated	1.1993	1.0847	1.2177
	Chromated Galvalume	AZ 50	CCA	0.2320	0.2816	0.4491
			ACQ	0.7252	1.5179	1.8081
			CA	0.5783	1.0894	1.4737
			Untreated	0.4623	0.2465	0.4640
	Galvalume plus Acrylic	AZ 55	CCA	0.0900	0.1082	0.2589
			ACQ	0.7252	0.5399	0.6337
			CA	0.8011	1.0955	1.2715
			Untreated	0.1092	0.1931	0.2592
Light Gauge Sheet Steel	Chromated Galvanized	G90 LG	CCA	0.5032	0.3855	0.6509
			ACQ	1.2277	1.3980	1.4185
			CA	0.5181	0.4295	0.6280
			Untreated	0.3783	0.0952	0.4225
	Galvanized plus Acrylic	G90 LG	CCA	0.4067	0.4170	0.4677
			ACQ	0.7741	0.7825	0.9720
			CA	0.4246	0.4981	0.6241
			Untreated	0.5810	0.1080	0.5216
	Chromated Galvalume	AZ 50 LG	CCA	0.0245	0.1174	0.1674
			ACQ	0.1646	0.2795	0.4335
			CA	0.1741	0.2759	0.4515
			Untreated	0.0270	0.0527	0.1379
	Galvalume plus Acrylic	AZ 55 LG	CCA	0.0093	0.0098	0.0524
			ACQ	0.0958	0.2065	0.2681
			CA	0.1127	0.1173	0.1583
			Untreated	0.0101	0.0225	0.0381

For SI: 1 mil = 0.0254 mm, 1 pound = 453.6 grams

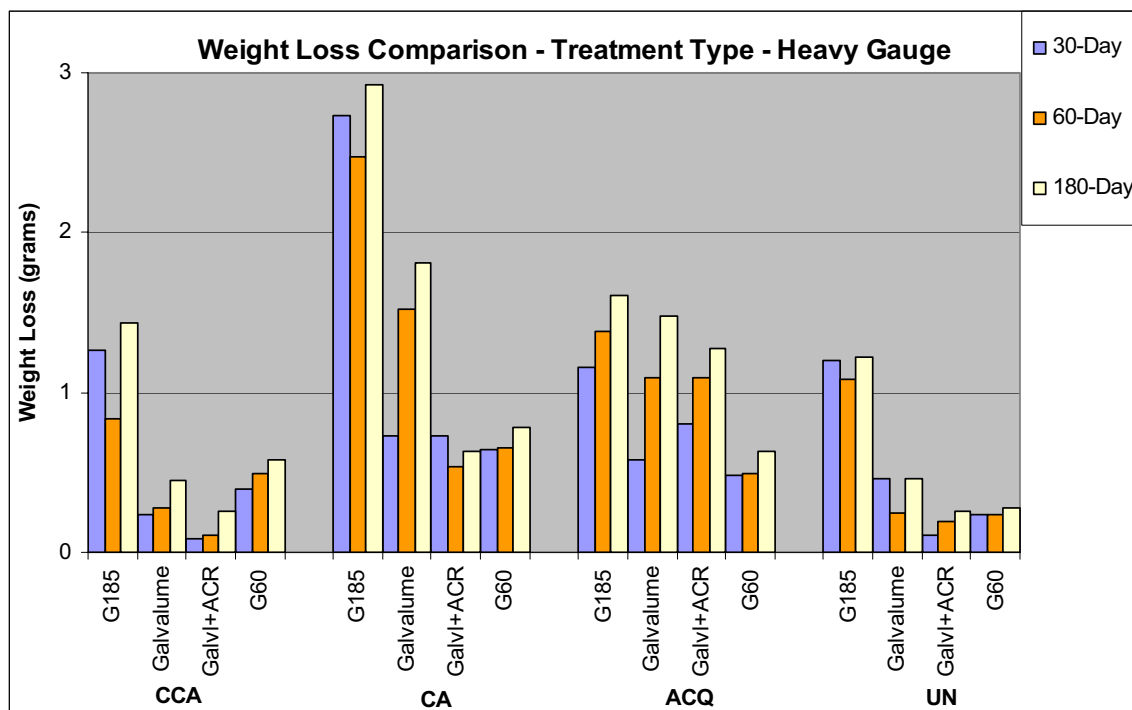


Figure 2 – Average Mass Loss Comparison – Treatment Type – Heavy Gauge

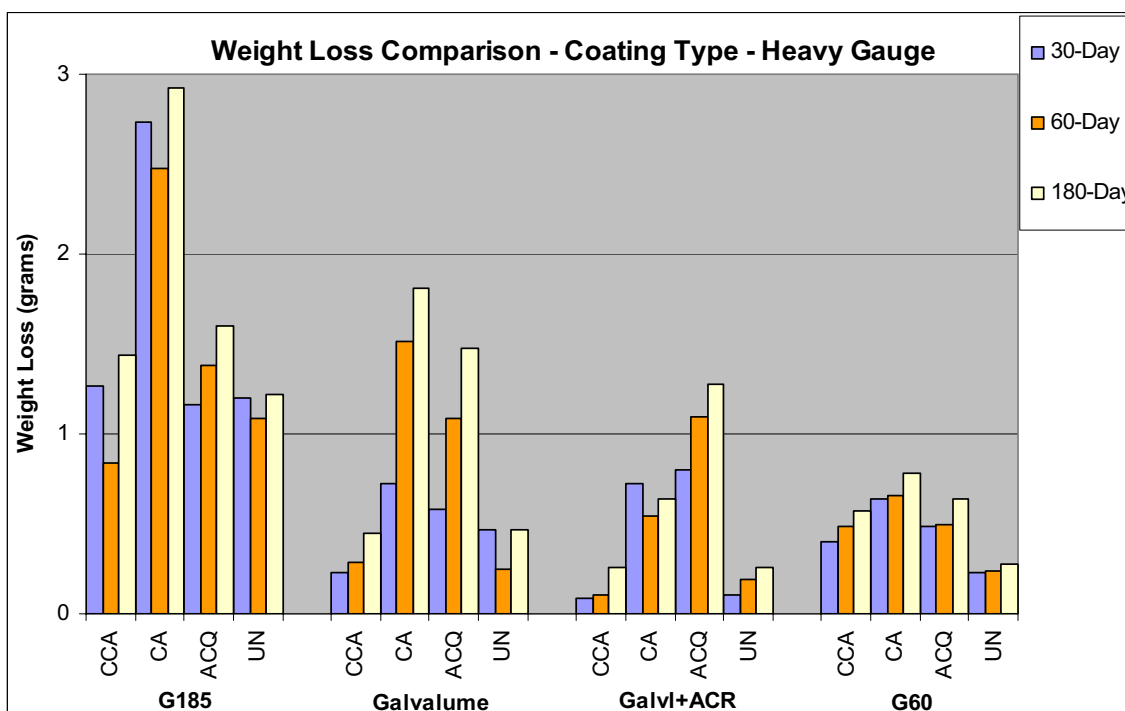


Figure 3 – Average Mass Loss Comparison – Coating Type – Heavy Gauge

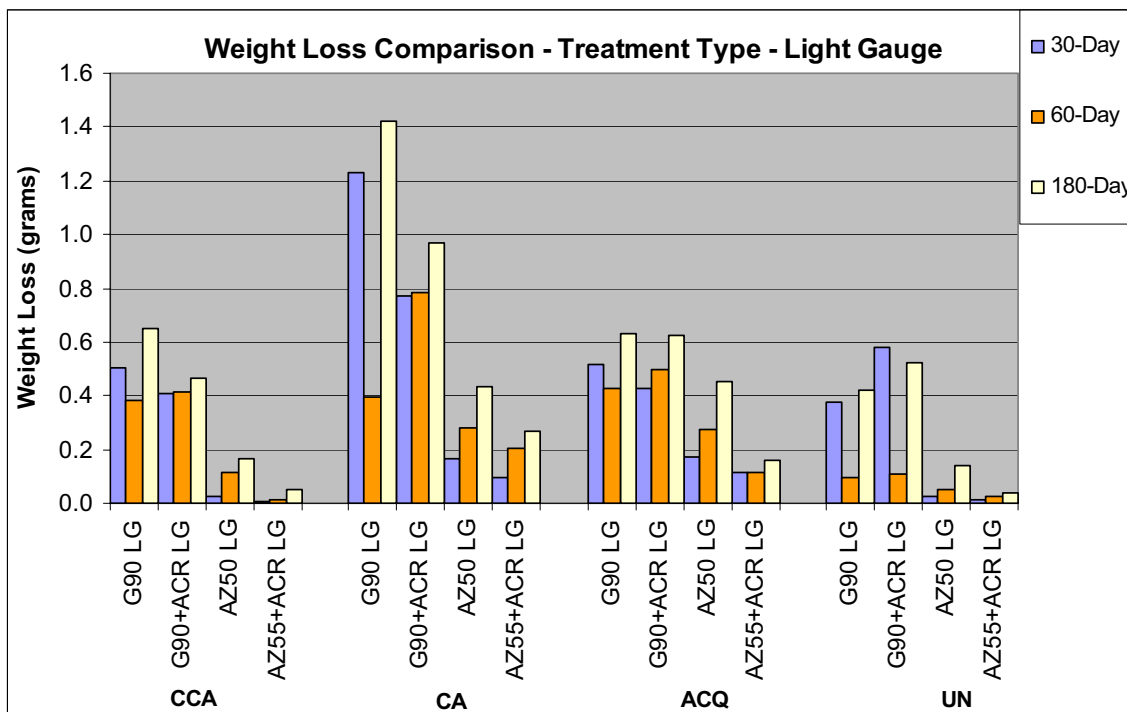


Figure 4 – Average Mass Loss Comparison – Treatment Type – Light Gauge

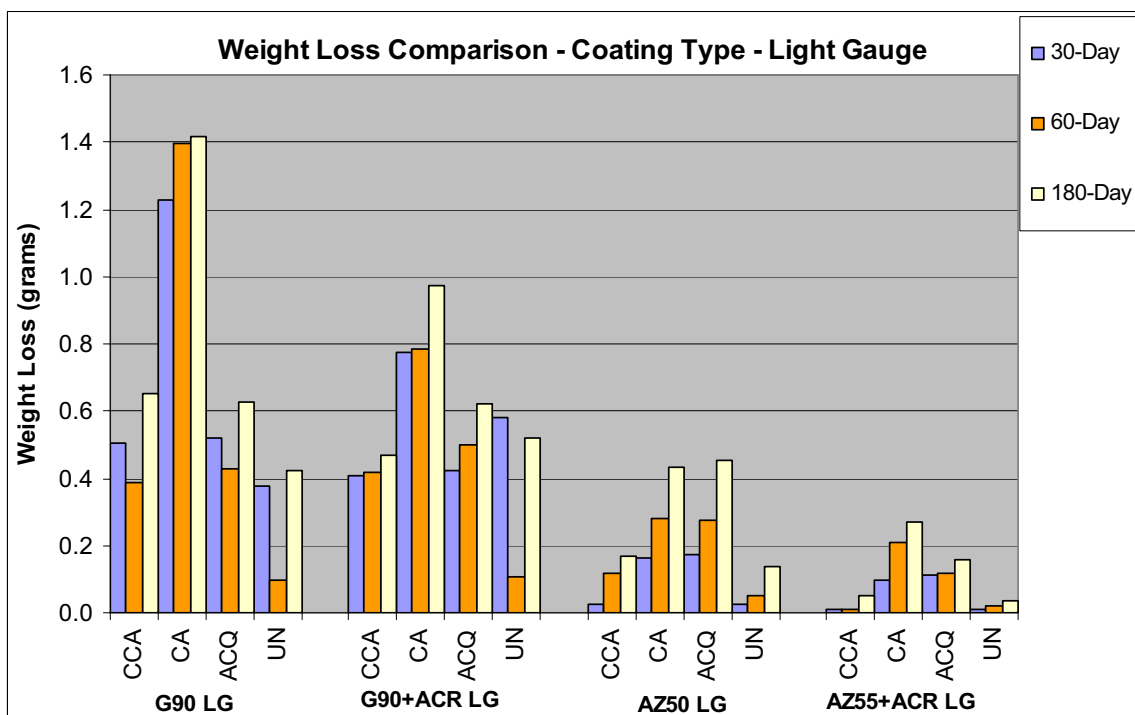


Figure 5 – Average Mass Loss Comparison – Treatment Type – Light Gauge

9.2 Fasteners

Table 9 shows the average mass loss, in grams, for the retrieved fastener specimens for the 15-day, 30-day, and 90-day retrievals in the different wood treatments. Figures 6 through 9 show the average weight loss by treatment type for both nails and screws.

Table 9 – Average Fastener Weight Loss

Fastener Type	Steel Type	Treated Wood	Average Weight Loss (grams)					
			15-Day		30-Day		90-Day	
			Test	Control	Test	Control	Test	Control
Screws	Zinclad	CCA	0.1966	0.1537	0.2633	0.236	0.2673	0.2304
		ACQ	0.2103	0.0891	0.23	0.2261	0.2367	0.2421
		CA	0.1966	0.1858	0.2253	0.208	0.2401	0.2119
		Untreated	0.2191	0.0897	0.2202	0.2253	0.2364	0.2282
	HGS	CCA	0.0167	0.0152	0.0236	0.0149	0.0242	0.0149
		ACQ	0.0169	0.0144	0.0223	0.0151	0.0218	0.0175
		CA	0.0165	0.0165	0.019	0.0157	0.0235	0.0172
		Untreated	0.0145	0.016	0.0159	0.0156	0.0167	0.0151
Nails	S263	CCA	0.1438	0.1347	0.1543	0.1459	0.161	0.1429
		ACQ	0.1288	0.1827	0.1353	0.1282	0.1347	0.1362
		CA	0.1371	0.1375	0.1561	0.1417	0.1617	0.1402
		Untreated	0.1275	0.1423	0.1419	0.1483	0.1491	0.1473
	HGN	CCA	0.1507	0.1639	0.1679	0.1707	0.1672	0.1743
		ACQ	0.1682	0.1823	0.1846	0.1759	0.1978	0.188
		CA	0.1859	0.1789	0.1885	0.1905	0.1892	0.2001
		Untreated	0.1693	0.1696	0.1704	0.1657	0.176	0.1759

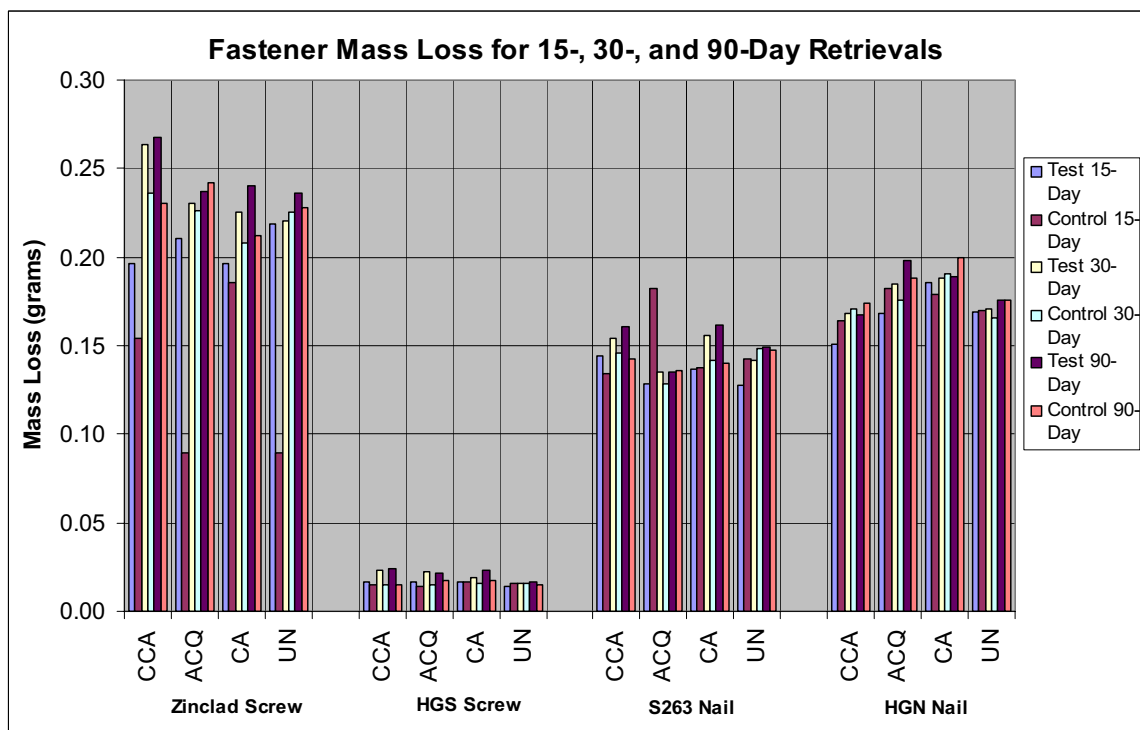


Figure 6 – Average Fastener Mass Loss Comparison – All Retrievals

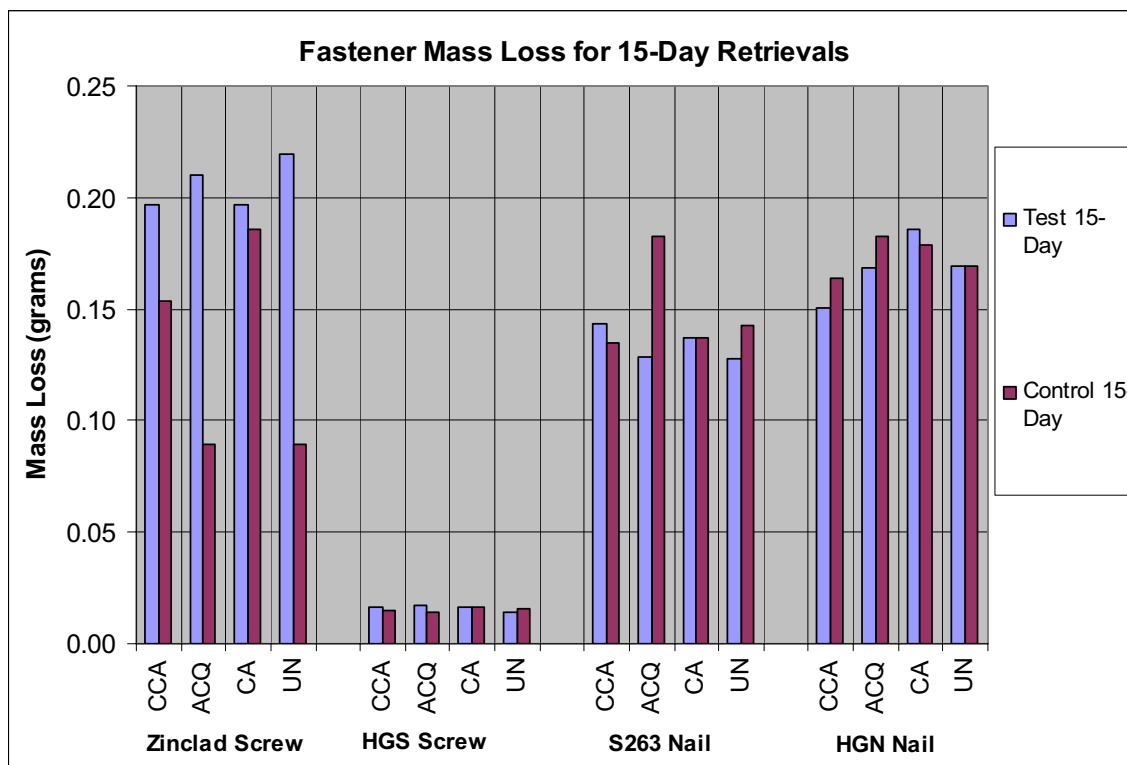


Figure 7 – Average Fastener Mass Loss – 15-Day Retrieval

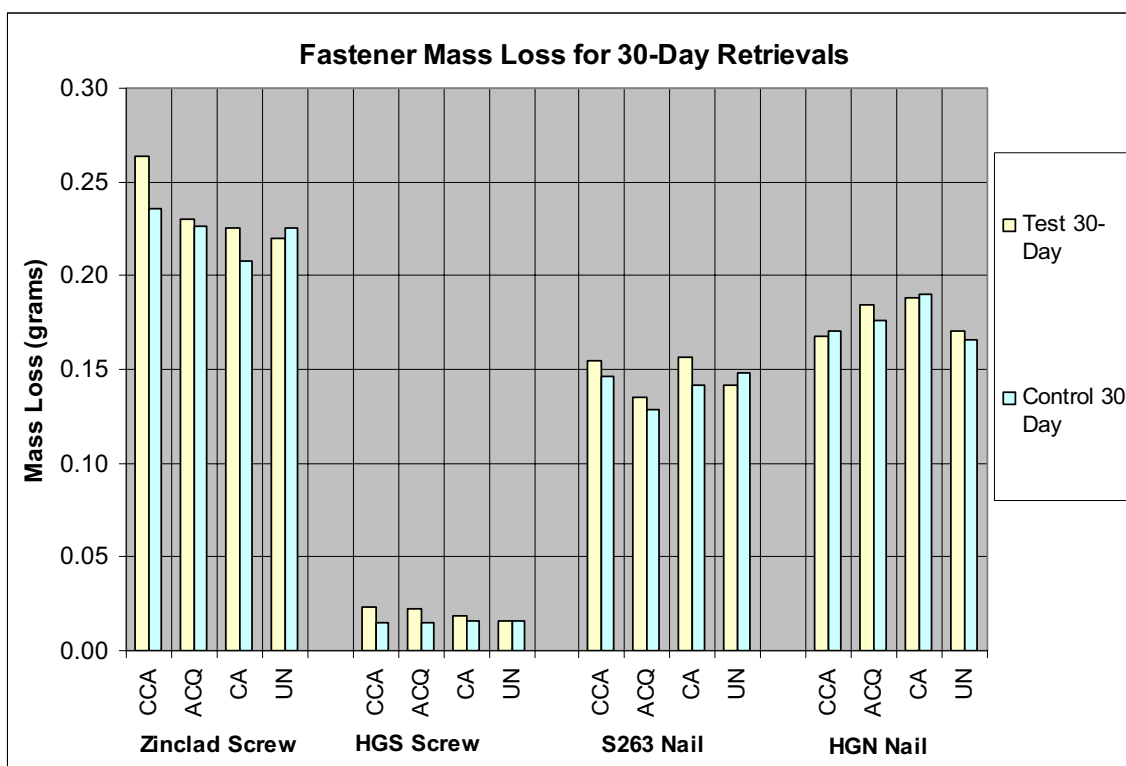


Figure 8 – Average Fastener Mass Loss – 30-Day Retrieval

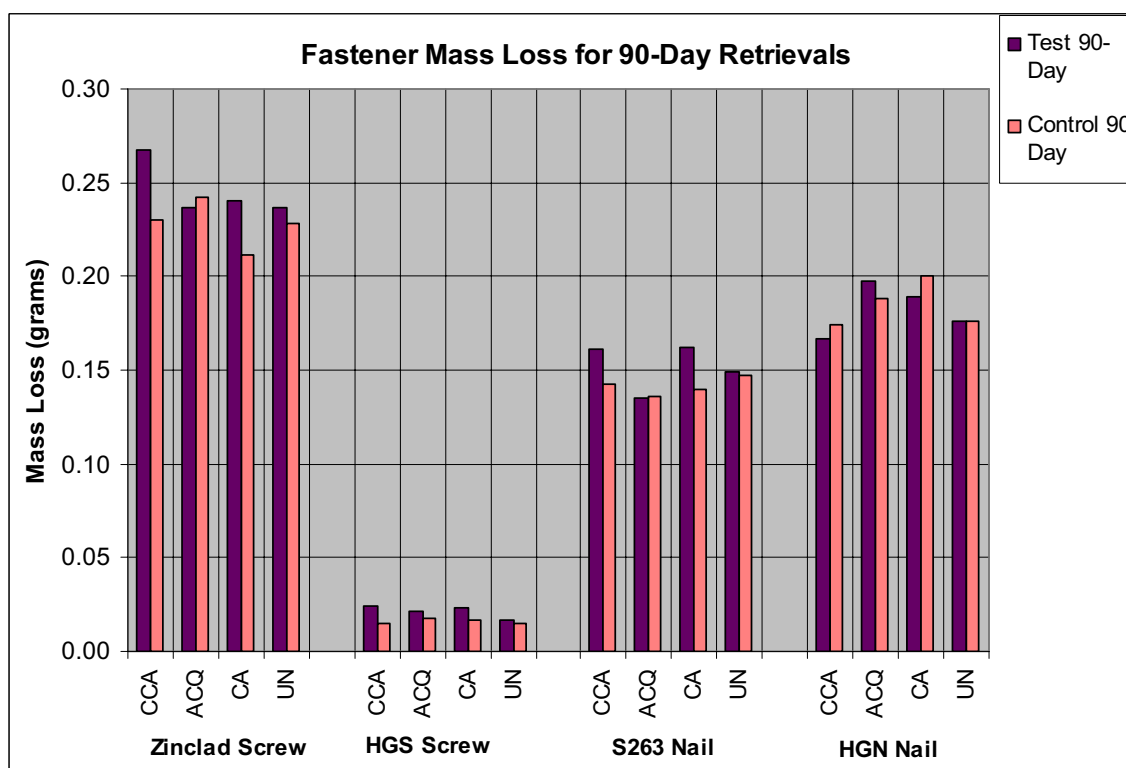


Figure 9 – Average Fastener Mass Loss – 90-Day Retrieval

10.0 SUMMARY

A total of 300 sheet steel specimens and 288 fastener specimens were tested and retrieved at intervals ranging from 30 to 180 days for sheet steel specimens and 15 to 180 days fastener specimens. Testing was conducted in accordance with a modified (cyclic) AWWA E12 test method to simulate cyclic wetness of the specimens. Most retrieved sheet steel specimens showed small traces of red rust after thirty days. The following observations are made from the retrieved sheet steel specimens:

1. The G-185 galvanized steel specimens had the most weight loss amongst the heavy gauge specimens in all wood treatments compared to other coating types.
2. The G-185 galvanized steel specimens in CA treated wood showed the most weight loss for both the 30-day and 60-day period compared to other treated wood.
3. The weight loss of almost all specimens stabilized after the initial 30-day period. The 60-day and 180-day weight loss was slightly higher, but not significantly higher, than the 30-day weight loss.
4. The G-90 plus acrylic coated steel specimens had the most weight loss amongst the light gauge specimens in all wood treatments compared to other coating types.
5. Light gauge steel specimens in contact with CA treated wood had the most weight loss compared to other wood treatment types.

The following observations are made from the retrieved fastener specimens:

1. Both nail and screw fasteners showed very little weight loss (corrosion) after being in the test chamber for up to 90 days.
2. Hot dipped galvanized screws showed the least amount of weight loss after cleaning (not necessarily the least amount of corrosion though).
3. Zinclud screws had the highest weight loss after cleaning.
4. The weights of the fasteners after cleaning were about the same for tested and untested specimens.
5. The different treatments did not have a significant impact on the weight loss of the fasteners (after cleaning).



APPENDIX A – TEST PHOTOS



Photo 1 – Wood Blocks

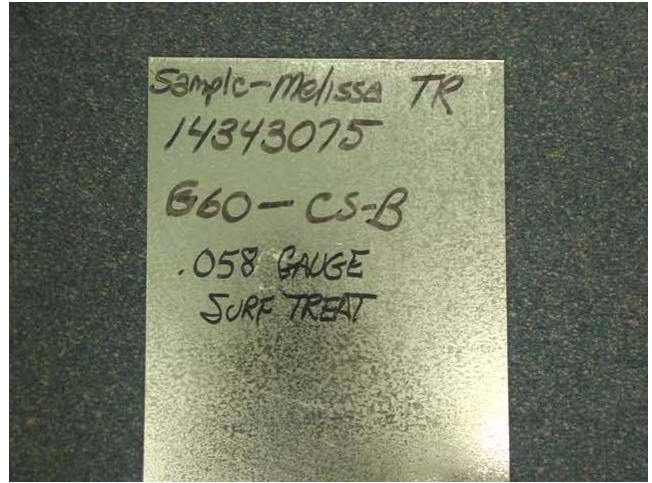


Photo 2 – Sheet Steel



Photo 3 – Steel Types



Photo 4 – Steel Specimens

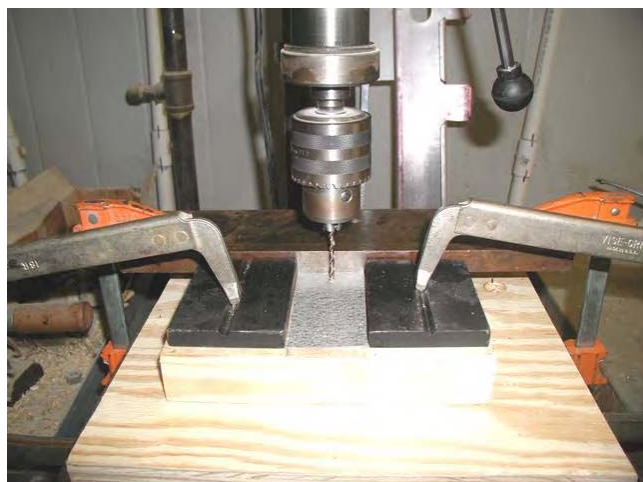


Photo 5 – Pre-Drilling Holes in Steel Coupons



Photo 6 – Scale Used to Weigh Specimens



Photo 7 – Driving Nails Through Specimen



Photo 8 – Specimen Ready For Testing



Photo 9 – Environmental Chamber



Photo 10 – Racks Within the Chamber



Photo 11 – Drainage for Each Rack



Photo 12 – Specimen inside Chamber



Photo 13 – De-Ionized Water for Spraying



Photo 14 – Equipment Used for Spraying



Photo 15 – Daily Spraying



Photo 16 – Specimens After Spraying



Photo 17 – Specimens Before Cleaning (30-Days)



Photo 18 – Specimens Before Cleaning (30-Days)



Photo 19 – Specimens Before Cleaning (30-Days)



Photo 20 – Specimens Before Cleaning (30-Days)

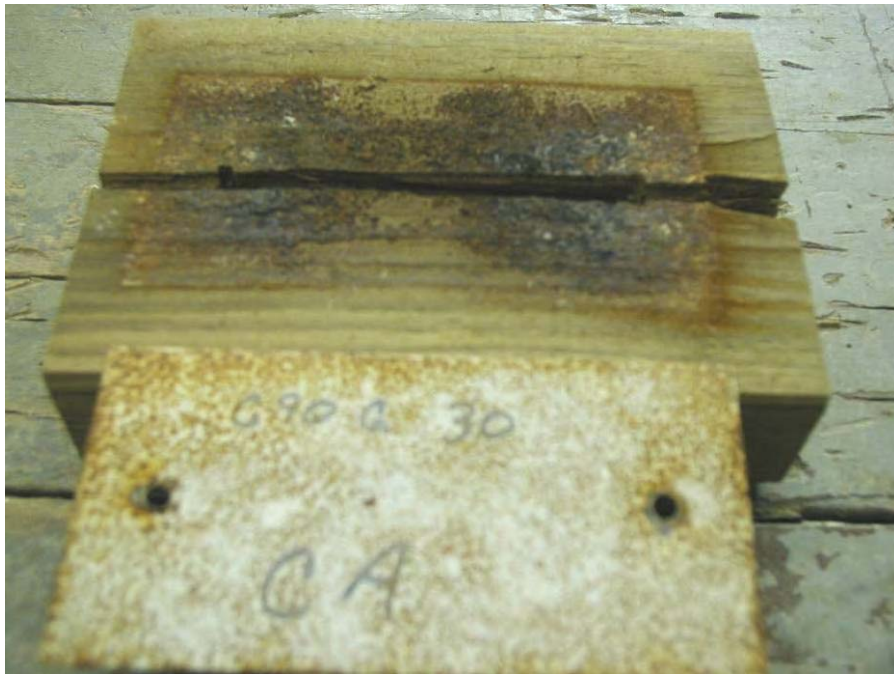


Photo 21 – Specimen in CA Treated Wood After 30-Days



Photo 22 – Specimen in ACQ Treated Wood After 30-Days



Photo 23 – Retrieved Samples (30-Days)



Photo 24 – ACQ, CA, & Untreated Retrieved Samples (30-Days)



Photo 25 – Exposed Side of CA Treated Sample (30-Days)



Photo 26 – Contact Side of CA Treated Sample (30-Days)



Photo 27 – Back of Specimens Before Cleaning (30-Days)



Photo 28 – Specimens After Cleaning (30-Days)



Photo 29 – Fastener Specimen After Testing – 15-Day



Photo 30 –Fastener Specimen After Testing – 15-Day



Photo 31 – Fastener Specimen After Testing – 15-Day

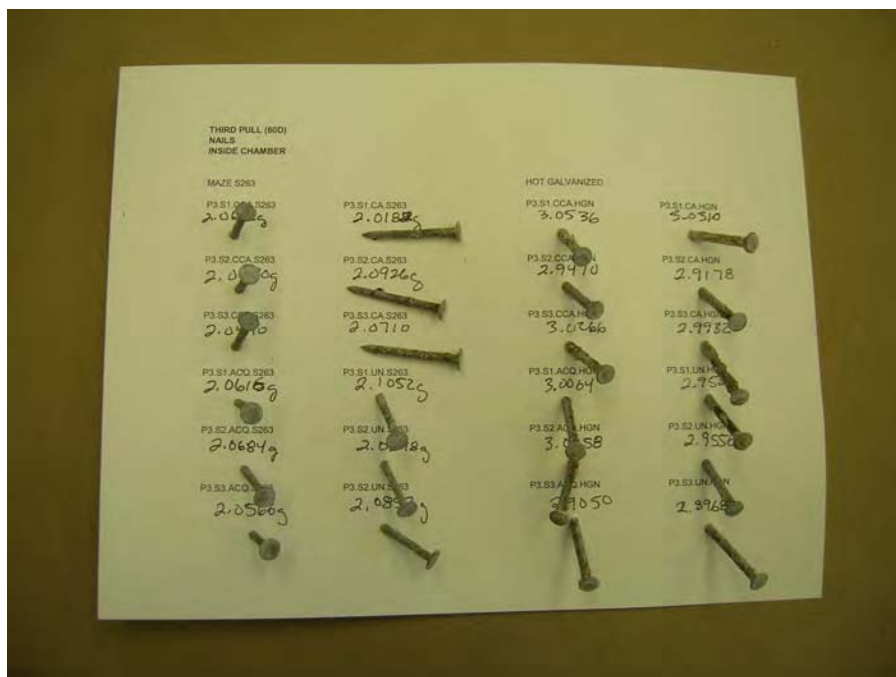


Photo 32 –Fastener Specimen After Testing – 15-Day



Photo 33 – Fastener Specimen After Testing – 15-Day

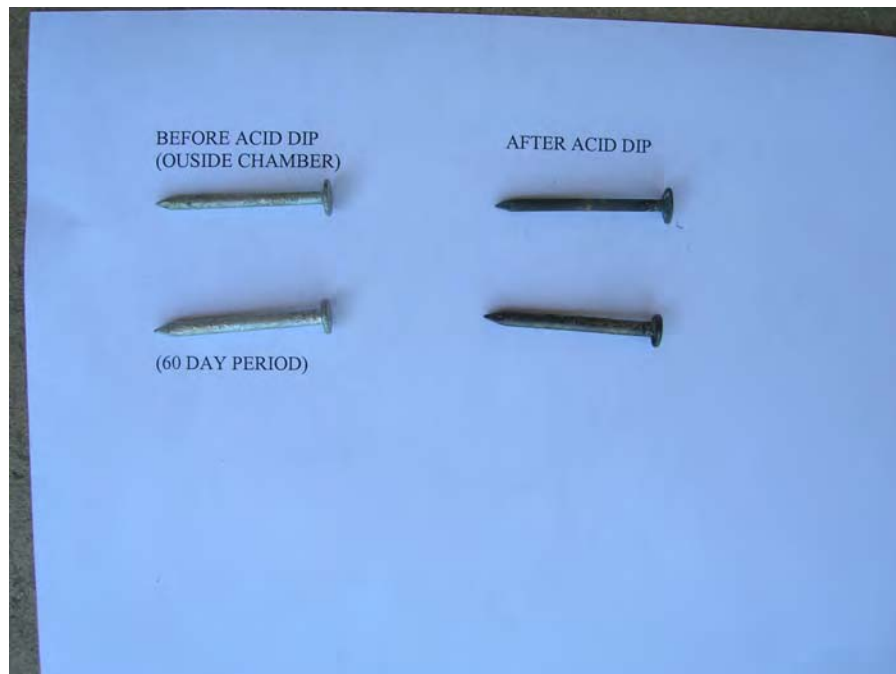


Photo 34 –Fastener Specimen After Testing – 15-Day



Photo 35 – Fastener Specimen After Testing – 30-Day



Photo 36 –Fastener Specimen After Testing – 30-Day

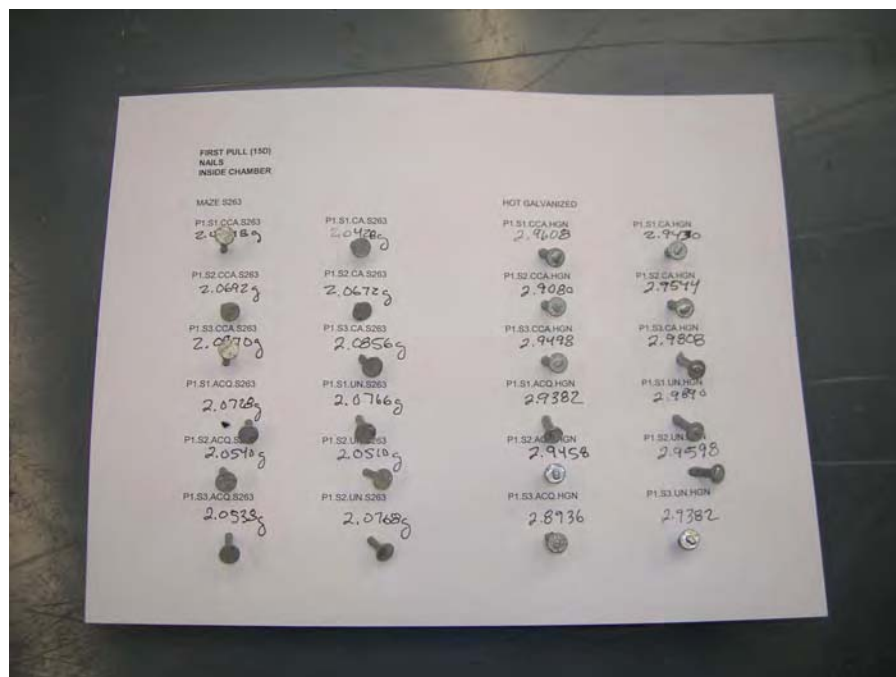


Photo 37 – Fastener Specimen Before Cleaning- 30-Day



Photo 38 –Fastener Specimen After Testing – 30-Day

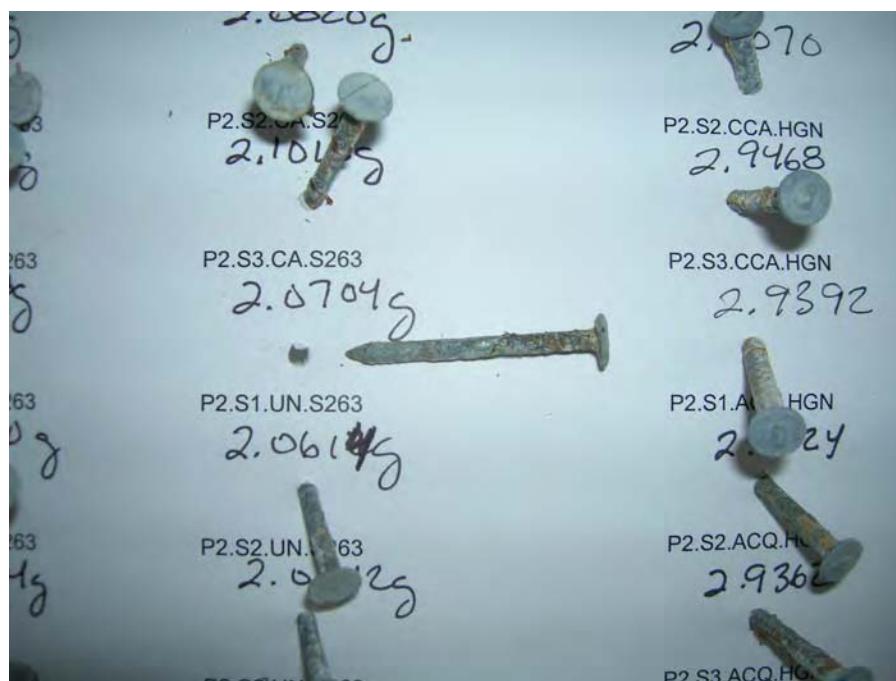


Photo 39 – Fastener Specimen After Testing – 30-Day

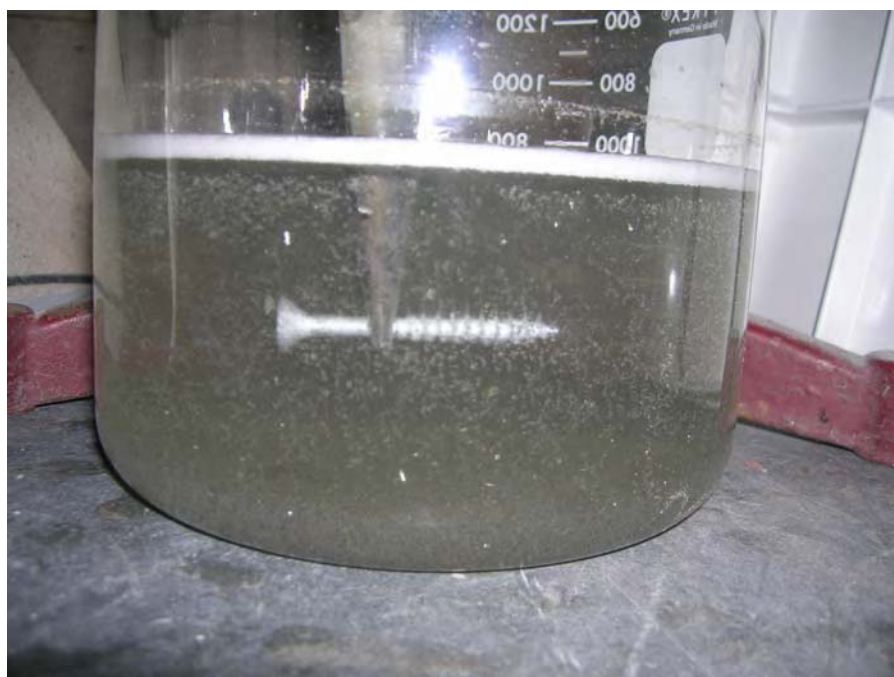


Photo 40 –Fastener Specimen During Cleaning – 30-Day

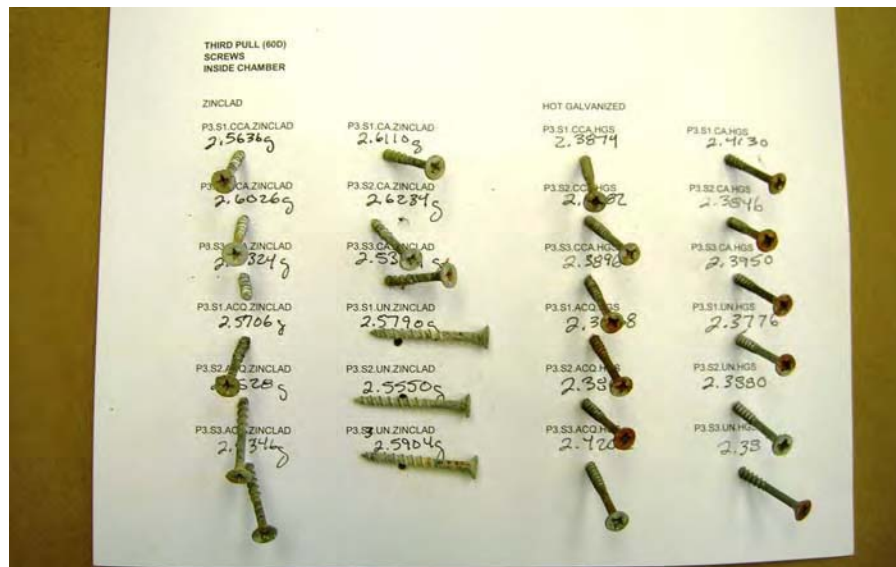


Photo 42 – Fastener Specimen After Testing – 90-Day

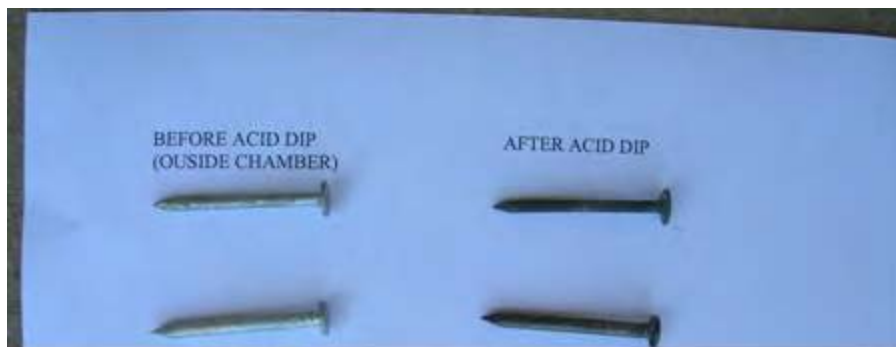


Photo 43 –Fastener Specimen After Testing – 90-Day

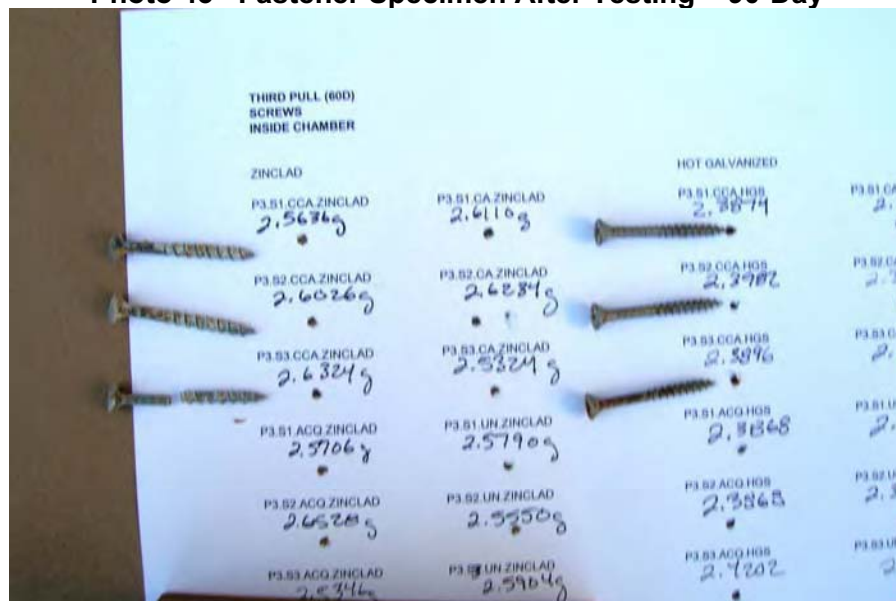


Photo 44 –Fastener Specimen After Testing – 90-Day

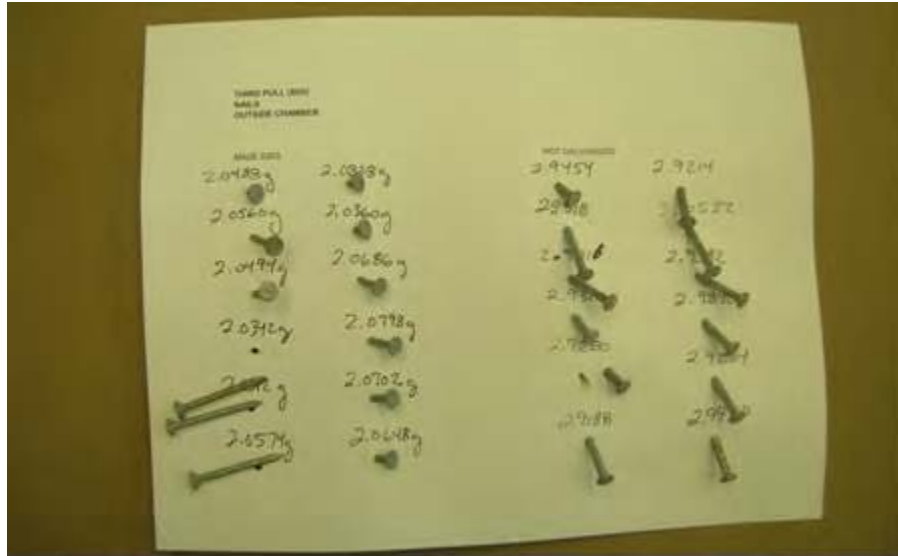


Photo 45 – Fastener Specimen After Testing – 90-Day

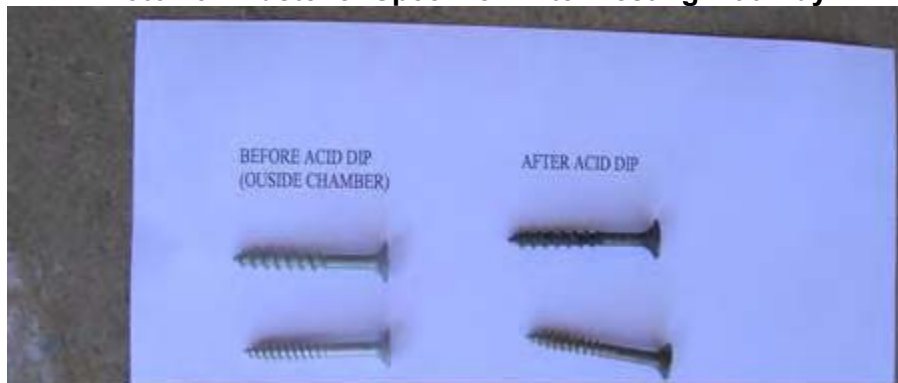


Photo 46 –Fastener Specimen After Testing – 90-Day

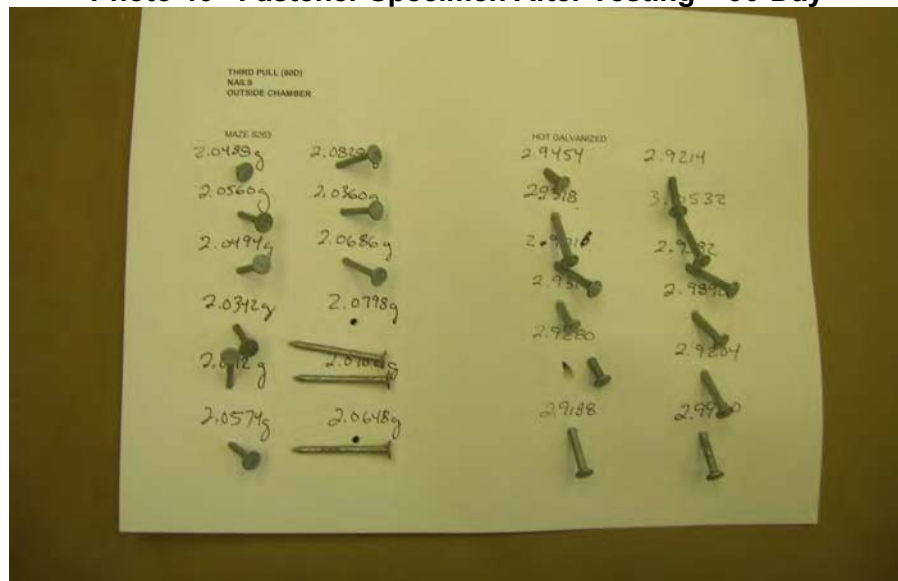


Photo 47 –Fastener Specimen After Testing – 90-Day



APPENDIX B – RETRIEVAL RESULTS



Table B1 – 30-Day Retrieval Results – Heavy and Light Gauge

Sample No.	Tested Specimen					Mech. Cleaning		Chemical Cleaning	
	Thickness mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Weight grams	Wt. Loss grams	Final Wt. grams	Wt. Loss grams
G60-1	54	Galvanized	G60	59.0966	CCA	57.8682	1.2284		
G60-2	54	Galvanized	G60	59.0462	CCA	58.3922	0.6540		
G60-3	54	Galvanized	G60	59.1140	CCA	59.0220	0.0920		
G60-4	54	Galvanized	G60	58.9868	CA	57.7378	1.2490		
G60-5	54	Galvanized	G60	62.0294	CA	61.0166	1.0128		
G60-6	54	Galvanized	G60	58.8018	CA	57.3254	1.4764		
G60-7	54	Galvanized	G60	61.8466	ACQ	60.7892	1.0574		
G60-8	54	Galvanized	G60	62.1222	ACQ	61.6778	0.4444		
G60-9	54	Galvanized	G60	59.1602	ACQ	58.9166	0.2436		
G60-10	54	Galvanized	G60	59.7182	UN	59.0050	0.7132		
G60-11	54	Galvanized	G60	58.9340	UN	58.1752	0.7588		
G60-12	54	Galvanized	G60	59.1746	UN	58.3070	0.8676		
G185-1	54	Galvanized	G185	68.1034	CCA	66.5632	1.5402	66.5632	1.5402
G185-2	54	Galvanized	G185	67.9930	CCA	67.0676	0.9254	67.0676	0.9254
G185-3	54	Galvanized	G185	67.9230	CCA	66.5862	1.3368	66.5862	1.3368
G185-4	54	Galvanized	G185	67.7772	CA	64.5860	3.1912	64.5860	3.1912
G185-5	54	Galvanized	G185	67.8322	CA	65.5152	2.3170	65.5152	2.3170
G185-6	54	Galvanized	G185	67.4734	CA	64.7842	2.6892	64.7842	2.6892
G185-7	54	Galvanized	G185	68.2034	ACQ	67.1718	1.0316	67.1718	1.0316
G185-8	54	Galvanized	G185	68.2652	ACQ	67.1786	1.0866	67.1786	1.0866
G185-9	54	Galvanized	G185	68.3532	ACQ	66.9942	1.3590	66.9942	1.3590
G185-10	54	Galvanized	G185	68.0284	UN	66.8608	1.1676	66.8608	1.1676
G185-11	54	Galvanized	G185	67.7284	UN	66.6280	1.1004	66.6280	1.1004
G185-35	54	Galvanized	G185	68.0438	UN	66.7140	1.3298	66.7140	1.3298
CG-1	54	Chromated Galvalume	AZ50	52.2008	CCA	52.0072	0.1936	52.0072	0.1936
CG-2	54	Chromated Galvalume	AZ50	52.2860	CCA	52.0786	0.2074	52.0786	0.2074
CG-3	54	Chromated Galvalume	AZ50	52.3938	CCA	52.0988	0.2950	52.0988	0.2950
CG-4	54	Chromated Galvalume	AZ50	51.8402	CA	50.6020	1.2382	50.6020	1.2382
CG-5	54	Chromated Galvalume	AZ50	52.3486	CA	51.3854	0.9632	51.3854	0.9632
CG-6	54	Chromated Galvalume	AZ50	52.1774	CA	51.1366	1.0408	51.1366	1.0408
CG-7	54	Chromated Galvalume	AZ50	52.3802	ACQ	51.6554	0.7248	51.6554	0.7248
CG-9	54	Chromated Galvalume	AZ50	51.8136	ACQ	50.9606	0.8530	50.9606	0.8530
CG-10	54	Chromated Galvalume	AZ50	52.5008	UN	52.3438	0.1570	52.3438	0.1570
CG-11	54	Chromated Galvalume	AZ50	52.4960	UN	52.2914	0.2046	52.2914	0.2046
CG-12	54	Chromated Galvalume	AZ50	52.1360	UN	51.9440	0.1920	51.9440	0.1920
CG-20	54	Chromated Galvalume	AZ50	52.3622	ACQ	51.3720	0.9902	51.3720	0.9902
G+A-1	54	Galvalume + Acrylic	AZ55	49.5010	CCA	49.4630	0.0380	49.4630	0.0380
G+A-2	54	Galvalume + Acrylic	AZ55	49.1492	CCA	49.0181	0.1311	49.0181	0.1311
G+A-3	54	Galvalume + Acrylic	AZ55	49.4206	CCA	49.3198	0.1008	49.3198	0.1008
G+A-4	54	Galvalume + Acrylic	AZ55	49.4668	CA	48.7546	0.7122	48.7546	0.7122
G+A-5	54	Galvalume + Acrylic	AZ55	49.2284	CA	48.5112	0.7172	48.5112	0.7172
G+A-6	54	Galvalume + Acrylic	AZ55	49.3728	CA	48.6266	0.7462	48.6266	0.7462
G+A-7	54	Galvalume + Acrylic	AZ55	49.4836	ACQ	48.8138	0.6698	48.8138	0.6698
G+A-8	54	Galvalume + Acrylic	AZ55	49.2816	ACQ	48.3770	0.9046	48.3770	0.9046
G+A-9	54	Galvalume + Acrylic	AZ55	49.0196	ACQ	48.1906	0.8290	48.1906	0.8290
G+A-10	54	Galvalume + Acrylic	AZ55	49.3088	UN	49.1876	0.1212	49.1876	0.1212
G+A-11	54	Galvalume + Acrylic	AZ55	49.5616	UN	49.4356	0.1260	49.4356	0.1260
G+A-12	54	Galvalume + Acrylic	AZ55	49.4090	UN	49.3286	0.0804	49.3286	0.0804
G90G-1	27	Galvanized	G90 LG	30.7342	CCA	30.2062	0.5280	30.2062	0.5280
G90G-2	27	Galvanized	G90 LG	30.4964	CCA	30.0756	0.4208	30.0756	0.4208
G90G-3	27	Galvanized	G90 LG	30.7760	CCA	30.2152	0.5608	30.2152	0.5608
G90G-4	27	Galvanized	G90 LG	30.3456	CA	29.1360	1.2096	29.1360	1.2096
G90G-5	27	Galvanized	G90 LG	30.6092	CA	29.4630	1.1462	29.4630	1.1462
G90G-6	27	Galvanized	G90 LG	31.2270	CA	29.8998	1.3272	29.8998	1.3272
G90G-7	27	Galvanized	G90 LG	30.6514	ACQ	30.2124	0.4390	30.2124	0.4390
G90G-8	27	Galvanized	G90 LG	30.9508	ACQ	30.3732	0.5776	30.3732	0.5776
G90G-9	27	Galvanized	G90 LG	31.6350	ACQ	31.0974	0.5376	31.0974	0.5376
G90G-10	27	Galvanized	G90 LG	30.8900	UN	30.5132	0.3768	30.5132	0.3768
G90G-11	27	Galvanized	G90 LG	31.2110	UN	30.8454	0.3656	30.8454	0.3656
G90G-12	27	Galvanized	G90 LG	31.4788	UN	31.0862	0.3926	31.0862	0.3926

Table B2 – 30-Day Retrieval Results – Light Gauge

Sample No.	Thick. Mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Final Weight grams	Weight Loss grams
G90A-1	27	Galvanized+Acrylic	G90	17.4710	CA	16.6900	0.7810
G90A-2	27	Galvanized+Acrylic	G90	17.5002	UN	17.0860	0.4142
G90A-3	27	Galvanized+Acrylic	G90	17.8896	ACQ	17.5176	0.3720
G90A-4	27	Galvanized+Acrylic	G90	18.0264	CCA	17.7920	0.2344
G90A-5	27	Galvanized+Acrylic	G90	16.6556	CA	16.0178	0.6378
G90A-6	27	Galvanized+Acrylic	G90	17.0950	UN	16.4124	0.6826
G90A-7	27	Galvanized+Acrylic	G90	17.4718	ACQ	16.9102	0.5616
G90A-8	27	Galvanized+Acrylic	G90	17.0926	CCA	16.4496	0.6430
G90A-9	27	Galvanized+Acrylic	G90	17.0230	CA	16.1194	0.9036
G90A-10	27	Galvanized+Acrylic	G90	16.8744	UN	16.2282	0.6462
G90A-11	27	Galvanized+Acrylic	G90	16.7644	ACQ	16.4242	0.3402
G90A-12	27	Galvanized+Acrylic	G90	16.8994	CCA	16.5568	0.3426
AZ50-1	23	Galvalume Chem Treat	AZ50	23.3966	CA	23.2376	0.1590
AZ50-2	23	Galvalume Chem Treat	AZ50	23.7340	UN	23.7132	0.0208
AZ50-3	23	Galvalume Chem Treat	AZ50	23.7720	ACQ	23.6388	0.1332
AZ50-4	23	Galvalume Chem Treat	AZ50	23.4696	CCA	23.4534	0.0162
AZ50-5	23	Galvalume Chem Treat	AZ50	23.5128	CA	23.3514	0.1614
AZ50-6	23	Galvalume Chem Treat	AZ50	23.5760	UN	23.5350	0.0410
AZ50-7	23	Galvalume Chem Treat	AZ50	23.5088	ACQ	23.2800	0.2288
AZ50-8	23	Galvalume Chem Treat	AZ50	23.4764	CCA	23.4460	0.0304
AZ50-9	23	Galvalume Chem Treat	AZ50	23.3762	CA	23.2028	0.1734
AZ50-10	23	Galvalume Chem Treat	AZ50	23.6706	UN	23.6514	0.0192
AZ50-11	23	Galvalume Chem Treat	AZ50	23.5028	ACQ	23.3426	0.1602
AZ50-12	23	Galvalume Chem Treat	AZ50	23.6886	CCA	23.6616	0.0270
AZ55-1	20	Galvalume + Acrylic	AZ55	18.9956	CA	18.9200	0.0756
AZ55-2	20	Galvalume + Acrylic	AZ55	19.0520	UN	19.0488	0.0032
AZ55-3	20	Galvalume + Acrylic	AZ55	19.0990	ACQ	18.9750	0.1240
AZ55-4	20	Galvalume + Acrylic	AZ55	19.0300	CCA	19.0278	0.0022
AZ55-5	20	Galvalume + Acrylic	AZ55	18.9632	CA	18.8712	0.0920
AZ55-6	20	Galvalume + Acrylic	AZ55	18.9640	UN	18.9378	0.0262
AZ55-7	20	Galvalume + Acrylic	AZ55	19.0376	ACQ	18.9460	0.0916
AZ55-8	20	Galvalume + Acrylic	AZ55	18.3384	CCA	18.3268	0.0116
AZ55-9	20	Galvalume + Acrylic	AZ55	19.1128	CA	18.9929	0.1199
AZ55-10	20	Galvalume + Acrylic	AZ55	19.1106	UN	19.1096	0.0010
AZ55-11	20	Galvalume + Acrylic	AZ55	18.9132	ACQ	18.7906	0.1226
AZ55-12	20	Galvalume + Acrylic	AZ55	19.1196	CCA	19.1056	0.0140

Table B3 – 30-Day Retrieval Results – New G60 Samples – Heavy Gauge

Sample No.	Tested Specimens					Final Weight grams	Weight Loss grams
	Thickness mil	Coating Type	Coating Thicknes	Initial Weight grams	Treatment		
G60-1-N	54	Galvanized	G60	70.9144	CCA	70.5206	0.3938
G60-2-N	54	Galvanized	G60	69.4106	CCA	69.0170	0.3936
G60-3-N	54	Galvanized	G60	67.6120	CCA	67.1970	0.4150
G60-4-N	54	Galvanized	G60	64.9092	CA	64.3142	0.5950
G60-5-N	54	Galvanized	G60	73.0268	CA	72.3494	0.6774
G60-6-N	54	Galvanized	G60	67.0074	CA	66.3540	0.6534
G60-7-N	54	Galvanized	G60	67.9894	ACQ	67.4608	0.5286
G60-8-N	54	Galvanized	G60	65.6122	ACQ	65.1682	0.4440
G60-9-N	54	Galvanized	G60	70.5452	ACQ	70.0558	0.4894
G60-10-N	54	Galvanized	G60	71.4730	UN	71.2582	0.2148
G60-11-N	54	Galvanized	G60	71.9524	UN	71.6998	0.2526
G60-12-N	54	Galvanized	G60	71.4786	UN	71.2528	0.2258

Table B4 – 60-Day Retrieval Results – New G60 Samples – Heavy Gauge

Sample No.	Tested Specimens					Final Weight grams	Weight Loss grams
	Thickness mil	Coating Type	Coating Thicknes	Initial Weight grams	Treatment		
G60-13-N	54	Galvanized	G60	65.8688	CCA	65.3558	0.5130
G60-14-N	54	Galvanized	G60	63.8112	CCA	63.2610	0.5502
G60-15-N	54	Galvanized	G60	68.8236	CCA	68.4226	0.4010
G60-16-N	54	Galvanized	G60	68.7396	CA	68.1100	0.6296
G60-17-N	54	Galvanized	G60	81.7846	CA	81.1184	0.6662
G60-18-N	54	Galvanized	G60	72.8052	CA	72.1368	0.6684
G60-19-N	54	Galvanized	G60	67.1246	ACQ	66.6598	0.4648
G60-20-N	54	Galvanized	G60	68.9724	ACQ	68.4416	0.5308
G60-21-N	54	Galvanized	G60	72.6690	ACQ	72.1730	0.4960
G60-22-N	54	Galvanized	G60	76.8760	UN	76.6114	0.2646
G60-23-N	54	Galvanized	G60	70.4808	UN	70.2601	0.2207
G60-24-N	54	Galvanized	G60	70.0216	UN	69.7838	0.2378

Table B5 – 60-Day Retrieval Results – Heavy and Light Gauge

Specimen No.	Thick. Mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Final Weighty grams	Weight Loss grams
Sheet Steel	54	Galvanized	G185	68.0904	CCA	67.2890	0.8014
Sheet Steel	54	Galvanized	G185	68.1636	CCA	67.1870	0.9766
Sheet Steel	54	Galvanized	G185	68.3194	CCA	67.5826	0.7368
Sheet Steel	54	Galvanized	G185	67.9580	CA	66.0124	1.9456
Sheet Steel	54	Galvanized	G185	68.7038	CA	66.1534	2.5504
Sheet Steel	54	Galvanized	G185	68.5108	CA	65.5678	2.9430
Sheet Steel	54	Galvanized	G185	68.4778	ACQ	66.9690	1.5088
Sheet Steel	54	Galvanized	G185	67.7536	ACQ	66.2798	1.4738
Sheet Steel	54	Galvanized	G185	67.4956	ACQ	66.3340	1.1616
Sheet Steel	54	Galvanized	G185	67.9924	UN	66.8340	1.1584
Sheet Steel	54	Galvanized	G185	67.6408	UN	66.6920	0.9488
Sheet Steel	54	Chromated Galvalume	AZ50	52.4302	ACQ	51.3522	1.0780
Sheet Steel	54	Chromated Galvalume	AZ50	51.9292	CCA	51.6538	0.2754
Sheet Steel	54	Chromated Galvalume	AZ50	51.8254	CCA	51.5184	0.3070
Sheet Steel	54	Chromated Galvalume	AZ50	51.7352	CCA	51.4728	0.2624
Sheet Steel	54	Chromated Galvalume	AZ50	52.3986	CA	51.1038	1.2948
Sheet Steel	54	Chromated Galvalume	AZ50	52.2856	CA	50.5192	1.7664
Sheet Steel	54	Chromated Galvalume	AZ50	52.3200	CA	50.8276	1.4924
Sheet Steel	54	Chromated Galvalume	AZ50	52.4954	ACQ	51.4414	1.0540
Sheet Steel	54	Chromated Galvalume	AZ50	52.4620	ACQ	51.3259	1.1361
Sheet Steel	54	Chromated Galvalume	AZ50	52.4688	UN	52.2524	0.2164
Sheet Steel	54	Chromated Galvalume	AZ50	51.7070	UN	51.4274	0.2796
Sheet Steel	54	Chromated Galvalume	AZ50	52.3168	UN	52.0734	0.2434
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.4426	CCA	49.3086	0.1340
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.4506	CCA	49.3264	0.1242
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.5820	CCA	49.5156	0.0664
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.3848	CA	48.8616	0.5232
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.5352	CA	48.8758	0.6594
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.5254	CA	49.0882	0.4372
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.5912	ACQ	48.3292	1.2620
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.4408	ACQ	48.7302	0.7106
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.4544	ACQ	48.1406	1.3138
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.5414	UN	49.3338	0.2076
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.2974	UN	49.1472	0.1502
Sheet Steel	54	Galvalume + Acrylic	AZ55	49.3160	UN	49.0946	0.2214
Sheet Steel	27	Galvanized	G90	31.3036	CCA	30.8588	0.4448
Sheet Steel	27	Galvanized	G90	31.0762	CCA	30.7828	0.2934
Sheet Steel	27	Galvanized	G90	30.6960	CCA	30.2778	0.4182
Sheet Steel	27	Galvanized	G90	30.9472	CA	29.5866	1.3606
Sheet Steel	27	Galvanized	G90	30.9236	CA	29.3126	1.6110
Sheet Steel	27	Galvanized	G90	30.8428	CA	29.6204	1.2224
Sheet Steel	27	Galvanized	G90	31.1480	ACQ	30.8092	0.3388
Sheet Steel	27	Galvanized	G90	30.6460	ACQ	30.3244	0.3216
Sheet Steel	27	Galvanized	G90	31.7184	ACQ	31.0902	0.6282
Sheet Steel	27	Galvanized	G90	31.1878	UN	31.0890	0.0988
Sheet Steel	27	Galvanized	G90	30.7718	UN	30.6494	0.1224
Sheet Steel	27	Galvanized	G90	31.3190	UN	31.2546	0.0644

Table B6 – 60-Day Retrieval Results – Light Gauge

Sample Number	Thick. mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Final Weight grams	Weight Loss grams
G90A-16	27	Galvanized+Acrylic	G90	16.8644	CCA	16.5498	0.3146
G90A-20	27	Galvanized+Acrylic	G90	16.9542	CCA	16.7440	0.2102
G90A-24	27	Galvanized+Acrylic	G90	16.9584	CCA	16.2320	0.7264
G90A-13	27	Galvanized+Acrylic	G90	16.6742	CA	16.0724	0.6018
G90A-17	27	Galvanized+Acrylic	G90	16.8530	CA	16.0190	0.8340
G90A-21	27	Galvanized+Acrylic	G90	16.9676	CA	16.0560	0.9116
G90A-19	27	Galvanized+Acrylic	G90	16.8358	ACQ	16.5066	0.3292
G90A-15	27	Galvanized+Acrylic	G90	16.6856	ACQ	16.3310	0.3546
G90A-23	27	Galvanized+Acrylic	G90	16.9564	ACQ	16.7836	0.1728
G90A-14	27	Galvanized+Acrylic	G90	16.5944	UN	16.3096	0.2848
G90A-18	27	Galvanized+Acrylic	G90	16.8502	UN	16.5588	0.2914
G90A-22	27	Galvanized+Acrylic	G90	16.9114	UN	16.4562	0.4552
AZ50-16	23	Galvalume Chem Treat	AZ50	23.6152	CCA	23.5226	0.0926
AZ50-20	23	Galvalume Chem Treat	AZ50	23.7202	CCA	23.6840	0.0362
AZ50-24	23	Galvalume Chem Treat	AZ50	23.5150	CCA	23.2916	0.2234
AZ50-13	23	Galvalume Chem Treat	AZ50	23.6944	CA	23.2192	0.4752
AZ50-17	23	Galvalume Chem Treat	AZ50	23.6984	CA	23.5378	0.1606
AZ50-21	23	Galvalume Chem Treat	AZ50	23.7384	CA	23.5356	0.2028
AZ50-15	23	Galvalume Chem Treat	AZ50	23.6834	ACQ	23.6740	0.0094
AZ50-19	23	Galvalume Chem Treat	AZ50	23.6124	ACQ	23.3646	0.2478
AZ50-23	23	Galvalume Chem Treat	AZ50	23.7444	ACQ	23.1740	0.5704
AZ50-14	23	Galvalume Chem Treat	AZ50	23.5388	UN	23.4878	0.0510
AZ50-18	23	Galvalume Chem Treat	AZ50	23.7320	UN	23.6660	0.0660
AZ50-22	23	Galvalume Chem Treat	AZ50	23.6580	UN	23.6168	0.0412
AZ55-16	20	Galvalume + Acrylic	AZ55	19.0924	CCA	19.0844	0.0080
AZ55-20	20	Galvalume + Acrylic	AZ55	19.0618	CCA	19.0500	0.0118
AZ55-24	20	Galvalume + Acrylic	AZ55	19.0656	CCA	19.0560	0.0096
AZ55-13	20	Galvalume + Acrylic	AZ55	19.1272	CA	18.9588	0.1684
AZ55-17	20	Galvalume + Acrylic	AZ55	19.119	CA	18.8240	0.2950
AZ55-21	20	Galvalume + Acrylic	AZ55	19.1028	CA	18.9468	0.1560
AZ55-15	20	Galvalume + Acrylic	AZ55	19.0468	ACQ	18.9554	0.0914
AZ55-19	20	Galvalume + Acrylic	AZ55	19.1058	ACQ	18.9438	0.1620
AZ55-23	20	Galvalume + Acrylic	AZ55	19.0198	ACQ	18.9212	0.0986
AZ55-14	20	Galvalume + Acrylic	AZ55	19.1492	UN	19.1452	0.0040
AZ55-18	20	Galvalume + Acrylic	AZ55	19.103	UN	19.0758	0.0272
AZ55-22	20	Galvalume + Acrylic	AZ55	19.0206	UN	18.9842	0.0364

Table B7 – 180-Day Retrieval Results – New G60 Samples – Heavy Gauge

Sample Designation	Thickness mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Weight grams	Weight Loss grams
G60-25-N	54	Galvanized	G60	70.1038	CCA	69.5512	0.5526
G60-26-N	54	Galvanized	G60	70.6420	CCA	70.0497	0.5923
G60-27-N	54	Galvanized	G60	67.2362	CCA	66.6531	0.5831
G60-28-N	54	Galvanized	G60	74.3488	CA	73.5536	0.7952
G60-29-N	54	Galvanized	G60	67.7686	CA	67.0184	0.7502
G60-30-N	54	Galvanized	G60	69.8060	CA	69.0112	0.7948
G60-34-N	54	Galvanized	G60	70.1430	ACQ	69.4856	0.6574
G60-35-N	54	Galvanized	G60	71.8458	ACQ	71.2266	0.6192
G60-36-N	54	Galvanized	G60	70.4186	ACQ	69.7888	0.6298
G60-31-N	54	Galvanized	G60	70.2428	UN	69.9708	0.2720
G60-32-N	54	Galvanized	G60	72.0772	UN	71.8027	0.2745
G60-33-N	54	Galvanized	G60	73.1088	UN	72.8263	0.2825

Table B8 – 180-Day Retrieval Results – Heavy Gauge

Sample Designation	Thickness mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Weight grams	Weight Loss grams
G185-25	54	Galvanized	G185	65.8138	CCA	64.5130	1.3008
G185-26	54	Galvanized	G185	65.8880	CCA	63.9962	1.8918
G185-27	54	Galvanized	G185	65.5440	CCA	64.4270	1.1170
G185-28	54	Galvanized	G185	67.0038	CA	63.9548	3.0490
G185-29	54	Galvanized	G185	67.0746	CA	64.2840	2.7906
G185-30	54	Galvanized	G185	67.1060	CA	64.1658	2.9402
G185-31	54	Galvanized	G185	65.5218	ACQ	63.9198	1.6020
G185-32	54	Galvanized	G185	66.4386	ACQ	64.8312	1.6074
G185-33	54	Galvanized	G185	66.1590	ACQ	64.5596	1.5994
G185-24	54	Galvanized	G185	67.4740	UN	66.2400	1.2340
G185-34	54	Galvanized	G185	68.0438	UN	66.7880	1.2558
G185-36	54	Galvanized	G185	67.2378	UN	66.0744	1.1634
CG-25	54	Chromated Galvalume	AZ50	51.7148	CCA	51.2590	0.4558
CG-26	54	Chromated Galvalume	AZ50	52.0836	CCA	51.5928	0.4908
CG-27	54	Chromated Galvalume	AZ50	52.4232	CCA	52.0224	0.4008
CG-28	54	Chromated Galvalume	AZ50	51.5526	CA	49.5004	2.0522
CG-29	54	Chromated Galvalume	AZ50	51.5232	CA	49.5902	1.9330
CG-30	54	Chromated Galvalume	AZ50	51.4500	CA	50.0110	1.4390
CG-31	54	Chromated Galvalume	AZ50	50.4826	ACQ	48.9920	1.4906
CG-32	54	Chromated Galvalume	AZ50	50.4804	ACQ	48.8664	1.6140
CG-33	54	Chromated Galvalume	AZ50	50.0234	ACQ	48.7070	1.3164
CG-34	54	Chromated Galvalume	AZ50	51.9172	UN	51.4906	0.4266
CG-35	54	Chromated Galvalume	AZ50	52.6636	UN	52.1830	0.4806
CG-36	54	Chromated Galvalume	AZ50	52.2890	UN	51.8042	0.4848
G+A-25	54	Galvalume + Acrylic	AZ55	49.2058	CCA	48.9930	0.2128
G+A-26	54	Galvalume + Acrylic	AZ55	49.0732	CCA	48.7392	0.3340
G+A-27	54	Galvalume + Acrylic	AZ55	49.4478	CCA	49.2180	0.2298
G+A-28	54	Galvalume + Acrylic	AZ55	49.3384	CA	48.6482	0.6902
G+A-29	54	Galvalume + Acrylic	AZ55	49.3860	CA	48.7260	0.6600
G+A-30	54	Galvalume + Acrylic	AZ55	49.4558	CA	48.9050	0.5508
G+A-31	54	Galvalume + Acrylic	AZ55	49.3944	ACQ	48.0228	1.3716
G+A-32	54	Galvalume + Acrylic	AZ55	49.3408	ACQ	48.3150	1.0258
G+A-33	54	Galvalume + Acrylic	AZ55	49.2546	ACQ	47.8376	1.4170
G+A-34	54	Galvalume + Acrylic	AZ55	49.2079	UN	48.9206	0.2873
G+A-35	54	Galvalume + Acrylic	AZ55	49.2396	UN	48.9854	0.2542
G+A-36	54	Galvalume + Acrylic	AZ55	49.5542	UN	49.3180	0.2362

Table B9 – 180-Day Retrieval Results – Light Gauge

Sample Designation	Thickness mil	Coating Type	Coating Thickness	Initial Weight grams	Treatment	Weight grams	Weight Loss grams
G90G-25	27	Galvanized	G90	30.7164	CCA	29.9880	0.7284
G90G-26	27	Galvanized	G90	31.0968	CCA	30.6496	0.4472
G90G-27	27	Galvanized	G90	30.5640	CCA	29.7870	0.7770
G90G-28	27	Galvanized	G90	30.5906	CA	28.9970	1.5936
G90G-29	27	Galvanized	G90	30.3344	CA	28.7846	1.5498
G90G-30	27	Galvanized	G90	30.8076	CA	29.6954	1.1122
G90G-31	27	Galvanized	G90	29.5218	ACQ	28.9454	0.5764
G90G-32	27	Galvanized	G90	29.1738	ACQ	28.2066	0.9672
G90G-33	27	Galvanized	G90	29.1858	ACQ	28.8454	0.3404
G90G-34	27	Galvanized	G90	30.2730	UN	29.8256	0.4474
G90G-35	27	Galvanized	G90	30.9128	UN	30.5964	0.3164
G90G-36	27	Galvanized	G90	29.4802	UN	28.9764	0.5038
G90A-28	27	Galvanized+Acrylic	G90	16.9746	CCA	16.5388	0.4358
G90A-32	27	Galvanized+Acrylic	G90	16.9396	CCA	16.5160	0.4236
G90A-36	27	Galvanized+Acrylic	G90	16.9160	CCA	16.3724	0.5436
G90A-25	27	Galvanized+Acrylic	G90	16.9600	CA	15.9816	0.9784
G90A-29	27	Galvanized+Acrylic	G90	16.9796	CA	15.9950	0.9846
G90A-33	27	Galvanized+Acrylic	G90	16.9440	CA	15.9910	0.9530
G90A-27	27	Galvanized+Acrylic	G90	16.9750	ACQ	16.3660	0.6090
G90A-31	27	Galvanized+Acrylic	G90	16.9198	ACQ	16.2782	0.6416
G90A-35	27	Galvanized+Acrylic	G90	16.8660	ACQ	16.2442	0.6218
G90A-26	27	Galvanized+Acrylic	G90	16.9294	UN	16.4100	0.5194
G90A-30	27	Galvanized+Acrylic	G90	18.0584	UN	17.5112	0.5472
G90A-34	27	Galvanized+Acrylic	G90	16.9558	UN	16.4576	0.4982
AZ50-28	23	Galvalume Chem Treat	AZ50	23.5568	CCA	23.4056	0.1512
AZ50-32	23	Galvalume Chem Treat	AZ50	23.5596	CCA	23.4254	0.1342
AZ50-36	23	Galvalume Chem Treat	AZ50	23.6162	CCA	23.3994	0.2168
AZ50-25	23	Galvalume Chem Treat	AZ50	23.7584	CA	23.4040	0.3544
AZ50-29	23	Galvalume Chem Treat	AZ50	23.5822	CA	23.1720	0.4102
AZ50-33	23	Galvalume Chem Treat	AZ50	23.5344	CA	22.9984	0.5360
AZ50-27	23	Galvalume Chem Treat	AZ50	23.5018	ACQ	22.7878	0.7140
AZ50-31	23	Galvalume Chem Treat	AZ50	23.5578	ACQ	23.1902	0.3676
AZ50-35	23	Galvalume Chem Treat	AZ50	23.6716	ACQ	23.3988	0.2728
AZ50-26	23	Galvalume Chem Treat	AZ50	23.6412	UN	23.5172	0.1240
AZ50-30	23	Galvalume Chem Treat	AZ50	23.4588	UN	23.2972	0.1616
AZ50-34	23	Galvalume Chem Treat	AZ50	23.7146	UN	23.5864	0.1282
AZ55-28	20	Galvalume + Acrylic	AZ55	18.9674	CCA	18.9150	0.0524
AZ55-32	20	Galvalume + Acrylic	AZ55	19.035	CCA	18.9818	0.0532
AZ55-36	20	Galvalume + Acrylic	AZ55	19.1992	CCA	19.1476	0.0516
AZ55-25	20	Galvalume + Acrylic	AZ55	19.0846	CA	18.7190	0.3656
AZ55-29	20	Galvalume + Acrylic	AZ55	19.0218	CA	18.8310	0.1908
AZ55-33	20	Galvalume + Acrylic	AZ55	19.061	CA	18.8132	0.2478
AZ55-27	20	Galvalume + Acrylic	AZ55	19.0994	ACQ	18.7132	0.3862
AZ55-31	20	Galvalume + Acrylic	AZ55	19.1134	ACQ	19.1006	0.0128
AZ55-35	20	Galvalume + Acrylic	AZ55	19.1192	ACQ	19.0432	0.0760
AZ55-26	20	Galvalume + Acrylic	AZ55	19.1002	UN	19.0451	0.0551
AZ55-30	20	Galvalume + Acrylic	AZ55	19.0354	UN	19.0072	0.0282
AZ55-34	20	Galvalume + Acrylic	AZ55	19.1318	UN	19.1008	0.0310

Table B10 – Fastener 15-Day Retrieval Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Loss After Clean (grams)
P1.S1.CCA.ZINCLAD	#8 Screw	CCA	2.5942	2.5980	0.0038	2.358	0.2362
P1.S2.CCA.ZINCLAD			2.5606	2.5662	0.0056	2.3938	0.1668
P1.S3.CCA.ZINCLAD			2.5466	2.5492	0.0026	2.3598	0.1868
P1.S1.ACQ.ZINCLAD		ACQ	2.5806	2.5834	0.0028	2.3714	0.2092
P1.S2.ACQ.ZINCLAD			2.5356	2.5380	0.0024	2.3378	0.1978
P1.S3.ACQ.ZINCLAD			2.5682	2.5714	0.0032	2.3444	0.2238
P1.S1.CA.ZINCLAD		CA	2.5278	2.5316	0.0038	2.3462	0.1816
P1.S2.CA.ZINCLAD			2.5092	2.5150	0.0058	2.3078	0.2014
P1.S3.CA.ZINCLAD			2.6008	2.6056	0.0048	2.394	0.2068
P1.S1.UN.ZINCLAD		UN	2.5888	2.5928	0.0040	2.3804	0.2084
P1.S2.UN.ZINCLAD			2.6284	2.6318	0.0034	2.397	0.2314
P1.S3.UN.ZINCLAD			2.5902	2.5932	0.0030	2.3726	0.2176
P1.S1.CCA.HGS	#8 Screw	CCA	2.3970	2.3978	0.0008	2.3838	0.0132
P1.S2.CCA.HGS			2.3900	2.3912	0.0012	2.3744	0.0156
P1.S3.CCA.HGS			2.2948	2.2928	-0.0020	2.2736	0.0212
P1.S1.ACQ.HGS		ACQ	2.3900	2.3914	0.0014	2.374	0.016
P1.S2.ACQ.HGS			2.3988	2.3998	0.0010	2.3808	0.018
P1.S3.ACQ.HGS			2.3886	2.3882	-0.0004	2.3718	0.0168
P1.S1.CA.HGS		CA	2.3876	2.3874	-0.0002	2.3714	0.0162
P1.S2.CA.HGS			2.4006	2.4010	0.0004	2.383	0.0176
P1.S3.CA.HGS			2.3900	2.3912	0.0012	2.3744	0.0156
P1.S1.UN.HGS		UN	2.3848	2.3834	-0.0014	2.3702	0.0146
P1.S2.UN.HGS			2.2926	2.2920	-0.0006	2.2778	0.0148
P1.S3.UN.HGS			2.4008	2.3994	-0.0014	2.3868	0.014
P1.S1.CCA.S263	8d Nail	CCA	2.0698	2.0770	0.0072	1.9274	0.1424
P1.S2.CCA.S263			2.0692	2.0750	0.0058	1.93	0.1392
P1.S3.CCA.S263			2.0870	2.0952	0.0082	1.9372	0.1498
P1.S1.ACQ.S263		ACQ	2.0728	2.0770	0.0042	1.9418	0.131
P1.S2.ACQ.S263			2.0540	2.0588	0.0048	1.9284	0.1256
P1.S3.ACQ.S263			2.0538	2.0608	0.0070	1.924	0.1298
P1.S1.CA.S263		CA	2.0428	2.0460	0.0032	1.9156	0.1272
P1.S2.CA.S263			2.0672	2.0712	0.0040	1.9292	0.138
P1.S3.CA.S263			2.0856	2.0894	0.0038	1.9396	0.146
P1.S1.UN.S263		UN	2.0766	2.0806	0.0040	1.9496	0.127
P1.S2.UN.S263			2.0510	2.0548	0.0038	1.9238	0.1272
P1.S3.UN.S263			2.0768	2.9406	0.8638	1.9484	0.1284
P1.S1.CCA.HGN	8d Nail	CCA	2.9608	2.9682	0.0074	2.815	0.1458
P1.S2.CCA.HGN			2.9080	2.9134	0.0054	2.763	0.145
P1.S3.CCA.HGN			2.9498	2.9560	0.0062	2.7884	0.1614
P1.S1.ACQ.HGN		ACQ	2.9382	2.9414	0.0032	2.7652	0.173
P1.S2.ACQ.HGN			2.9458	2.9546	0.0088	2.7788	0.167
P1.S3.ACQ.HGN			2.8936	2.9024	0.0088	2.729	0.1646
P1.S1.CA.HGN		CA	2.9430	2.9514	0.0084	2.7732	0.1698
P1.S2.CA.HGN			2.9544	2.9642	0.0098	2.7636	0.1908
P1.S3.CA.HGN			2.9808	2.9866	0.0058	2.7836	0.1972
P1.S1.UN.HGN		UN	2.9890	2.9930	0.0040	2.8279	0.1611
P1.S2.UN.HGN			2.9598	2.9632	0.0034	2.7968	0.163
P1.S3.UN.HGN			2.9382	.8962	-0.0420	2.7544	0.1838

Table B11 – Fastener 15-Day Retrieval Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
P1.S1.CCA.ZINCLAD	#8 Screw	CCA	0.164	0.160	0.004
P1.S2.CCA.ZINCLAD			0.156	0.151	0.005
P1.S3.CCA.ZINCLAD			0.155	0.150	0.005
P1.S1.ACQ.ZINCLAD		ACQ	0.155	0.151	0.004
P1.S2.ACQ.ZINCLAD			0.164	0.159	0.005
P1.S3.ACQ.ZINCLAD			0.160	0.153	0.007
P1.S1.CA.ZINCLAD		CA	0.160	0.155	0.005
P1.S2.CA.ZINCLAD			0.150	0.145	0.005
P1.S3.CA.ZINCLAD			0.161	0.154	0.007
P1.S1.UN.ZINCLAD		UN	0.160	0.153	0.007
P1.S2.UN.ZINCLAD			0.162	0.157	0.005
P1.S3.UN.ZINCLAD			0.160	0.155	0.005
P1.S1.CCA.HGS	#8 Screw	CCA	N/A	0.164	N/A
P1.S2.CCA.HGS			N/A	0.164	N/A
P1.S3.CCA.HGS			N/A	0.164	N/A
P1.S1.ACQ.HGS		ACQ	N/A	0.163	N/A
P1.S2.ACQ.HGS			N/A	0.165	N/A
P1.S3.ACQ.HGS			N/A	0.164	N/A
P1.S1.CA.HGS		CA	N/A	0.164	N/A
P1.S2.CA.HGS			N/A	0.163	N/A
P1.S3.CA.HGS			N/A	0.163	N/A
P1.S1.UN.HGS		UN	N/A	0.164	N/A
P1.S2.UN.HGS			N/A	0.163	N/A
P1.S3.UN.HGS			N/A	0.158	N/A
P1.S1.CCA.S263	8d Nail	CCA	0.111	0.107	0.004
P1.S2.CCA.S263			0.110	0.107	0.003
P1.S3.CCA.S263			0.110	0.107	0.003
P1.S1.ACQ.S263		ACQ	0.110	0.108	0.002
P1.S2.ACQ.S263			0.110	0.107	0.003
P1.S3.ACQ.S263			0.111	0.107	0.004
P1.S1.CA.S263		CA	0.110	0.107	0.003
P1.S2.CA.S263			0.112	0.107	0.005
P1.S3.CA.S263			0.111	0.109	0.002
P1.S1.UN.S263		UN	0.110	0.107	0.003
P1.S2.UN.S263			0.112	0.108	0.004
P1.S3.UN.S263			0.112	0.108	0.004
P1.S1.CCA.HGN	8d Nail	CCA	N/A	0.133	N/A
P1.S2.CCA.HGN			N/A	0.132	N/A
P1.S3.CCA.HGN			N/A	0.131	N/A
P1.S1.ACQ.HGN		ACQ	N/A	0.131	N/A
P1.S2.ACQ.HGN			N/A	0.133	N/A
P1.S3.ACQ.HGN			N/A	0.137	N/A
P1.S1.CA.HGN		CA	N/A	0.131	N/A
P1.S2.CA.HGN			N/A	0.134	N/A
P1.S3.CA.HGN			N/A	0.132	N/A
P1.S1.UN.HGN		UN	N/A	0.132	N/A
P1.S2.UN.HGN			N/A	0.136	N/A
P1.S3.UN.HGN			N/A	0.132	N/A

Table B12 – Un-Tested Fastener 15-Day Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Loss After Clean (grams)
ZINCLAD 1	#8 Screw	CCA	2.5198	2.5198	0.0000	2.3376	0.1822
ZINCLAD 2			2.6000	2.5994	-0.0006	2.4698	0.1302
ZINCLAD 3			2.6606	2.6606	0.0000	2.5118	0.1488
ZINCLAD 4		ACQ	2.6210	2.6204	-0.0006	2.5332	0.0878
ZINCLAD 5			2.5406	2.5402	-0.0004	2.4648	0.0758
ZINCLAD 6			2.6668	2.6672	0.0004	2.563	0.1038
ZINCLAD 7		CA	2.5888	2.5892	0.0004	2.3878	0.2010
ZINCLAD 8			2.5182	2.5172	-0.0010	2.3456	0.1726
ZINCLAD 9			2.6214	2.621	-0.0004	2.4376	0.1838
ZINCLAD 10		UN	2.5964	2.5964	0.0000	2.4838	0.1126
ZINCLAD 11			2.5492	2.5494	0.0002	2.482	0.0672
ZINCLAD 12			2.5780	2.5788	0.0008	2.4886	0.0894
HGS 1	#8 Screw	CCA	2.3920	2.3924	0.0004	2.376	0.0160
HGS 2			2.3728	2.3734	0.0006	2.3582	0.0146
HGS 3			2.3892	2.3888	-0.0004	2.3742	0.0150
HGS 4		ACQ	2.3804	2.381	0.0006	2.3642	0.0162
HGS 5			2.3930	2.3936	0.0006	2.3786	0.0144
HGS 6			2.3810	2.3816	0.0006	2.3684	0.0126
HGS 7		CA	2.3918	2.3924	0.0006	2.3784	0.0134
HGS 8			2.3760	2.3764	0.0004	2.3618	0.0142
HGS 9			2.4008	2.4014	0.0006	2.379	0.0218
HGS 10		UN	2.3810	2.3816	0.0006	2.3676	0.0134
HGS 11			2.4058	2.4062	0.0004	2.3838	0.0220
HGS 12			2.3656	2.366	0.0004	2.353	0.0126
S263 1	8d Nail	CCA	2.0860	2.0864	0.0004	1.9212	0.1648
S263 2			2.0548	2.055	0.0002	1.9332	0.1216
S263 3			2.0408	2.0408	0.0000	1.9232	0.1176
S263 4		ACQ	2.0696	2.0696	0.0000	1.8228	0.2468
S263 5			2.0966	2.0966	0.0000	1.9322	0.1644
S263 6			2.0818	2.0816	-0.0002	1.945	0.1368
S263 7		CA	2.0374	2.0374	0.0000	1.9168	0.1206
S263 8			2.0720	2.0718	-0.0002	1.9338	0.1382
S263 9			2.0800	2.0796	-0.0004	1.9264	0.1536
S263 10		UN	2.0686	2.0684	-0.0002	1.9238	0.1448
S263 11			2.0694	2.0692	-0.0002	1.9338	0.1356
S263 12			2.0754	2.0752	-0.0002	1.929	0.1464
HGN 1	8d Nail	CCA	2.9542	2.954	-0.0002	2.7792	0.1750
HGN 2			2.9298	2.93	0.0002	2.7864	0.1434
HGN 3			3.0516	3.0516	0.0000	2.8784	0.1732
HGN 4		ACQ	2.9760	2.9758	-0.0002	2.794	0.1820
HGN 5			2.9696	2.9692	-0.0004	2.7894	0.1802
HGN 6			2.9530	2.953	0.0000	2.7684	0.1846
HGN 7		CA	2.9298	2.9294	-0.0004	2.7788	0.1510
HGN 8			3.0582	3.058	-0.0002	2.889	0.1692
HGN 9			2.9780	2.978	0.0000	2.7616	0.2164
HGN 10		UN	3.0416	3.042	0.0004	2.8778	0.1638
HGN 11			2.9424	2.9422	-0.0002	2.7772	0.1652
HGN 12			2.9545	2.9542	-0.0003	2.7748	0.1797

Table B13 – Un-Tested Fastener 15-Day Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
ZINCLAD 1	#8 Screw	CCA	0.160	0.154	0.006
ZINCLAD 2			0.162	0.157	0.005
ZINCLAD 3			0.165	0.162	0.003
ZINCLAD 4		ACQ	0.158	0.155	0.003
ZINCLAD 5			0.160	0.156	0.004
ZINCLAD 6			0.159	0.156	0.003
ZINCLAD 7		CA	0.164	0.158	0.006
ZINCLAD 8			0.159	0.153	0.006
ZINCLAD 9			0.158	0.154	0.004
ZINCLAD 10		UN	0.163	0.163	0.000
ZINCLAD 11			0.160	0.157	0.003
ZINCLAD 12			0.165	0.163	0.002
HGS 1	#8 Screw	CCA	N/A	0.164	N/A
HGS 2			N/A	0.165	N/A
HGS 3			N/A	0.163	N/A
HGS 4		ACQ	N/A	0.164	N/A
HGS 5			N/A	0.165	N/A
HGS 6			N/A	0.164	N/A
HGS 7		CA	N/A	0.164	N/A
HGS 8			N/A	0.164	N/A
HGS 9			N/A	0.165	N/A
HGS 10		UN	N/A	0.165	N/A
HGS 11			N/A	0.164	N/A
HGS 12			N/A	0.165	N/A
S263 1	8d Nail	CCA	0.112	0.107	0.005
S263 2			0.110	0.107	0.003
S263 3			0.110	0.107	0.003
S263 4		ACQ	0.112	0.107	0.005
S263 5			0.110	0.107	0.003
S263 6			0.110	0.107	0.003
S263 7		CA	0.111	0.107	0.004
S263 8			0.111	0.107	0.004
S263 9			0.112	0.107	0.005
S263 10		UN	0.111	0.107	0.004
S263 11			0.111	0.107	0.004
S263 12			0.111	0.107	0.004
HGN 1	8d Nail	CCA	N/A	0.131	N/A
HGN 2			N/A	0.131	N/A
HGN 3			N/A	0.132	N/A
HGN 4		ACQ	N/A	0.133	N/A
HGN 5			N/A	0.133	N/A
HGN 6			N/A	0.132	N/A
HGN 7		CA	N/A	0.131	N/A
HGN 8			N/A	0.131	N/A
HGN 9			N/A	0.131	N/A
HGN 10		UN	N/A	0.131	N/A
HGN 11			N/A	0.134	N/A
HGN 12			N/A	0.131	N/A

Table B14 – Fastener 30-Day Retrieval Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Loss After Clean (grams)
P2.S1.CCA.ZINCLAD	#8 Screw	CCA	2.6106	2.619	0.0084	2.3554	0.2552
P2.S2.CCA.ZINCLAD			2.6178	2.6286	0.0108	2.3326	0.2852
P2.S3.CCA.ZINCLAD			2.5876	2.6146	0.0270	2.338	0.2496
P2.S1.ACQ.ZINCLAD			2.6432	2.6498	0.0066	2.3924	0.2508
P2.S2.ACQ.ZINCLAD		ACQ	2.5596	2.5708	0.0112	2.349	0.2106
P2.S3.ACQ.ZINCLAD			2.5500	2.5616	0.0116	2.3214	0.2286
P2.S1.CA.ZINCLAD			2.5972	2.6032	0.0060	2.373	0.2242
P1.S2.CA.ZINCLAD		CA	2.5182	2.524	0.0058	2.315	0.2032
P2.S3.CA.ZINCLAD			2.6552	2.6776	0.0224	2.4068	0.2484
P2.S1.UN.ZINCLAD		UN	2.5840	2.5906	0.0066	2.3744	0.2096
P2.S2.UN.ZINCLAD			2.5812	2.5864	0.0052	2.3486	0.2326
P2.S3.UN.ZINCLAD			2.5524	2.5678	0.0154	2.334	0.2184
P2.S1.CCA.HGS	#8 Screw	CCA	2.3942	2.386	-0.0082	2.3672	0.0270
P2.S2.CCA.HGS			2.3780	2.3764	-0.0016	2.3592	0.0188
P2.S3.CCA.HGS			2.3980	2.3924	-0.0056	2.373	0.0250
P2.S1.ACQ.HGS		ACQ	2.3904	2.3906	0.0002	2.3734	0.0170
P2.S2.ACQ.HGS			2.3926	2.3864	-0.0062	2.3668	0.0258
P2.S3.ACQ.HGS			2.3956	2.3928	-0.0028	2.3714	0.0242
P2.S1.CA.HGS		CA	2.3926	2.3914	-0.0012	2.3714	0.0212
P2.S2.CA.HGS			2.3956	2.3934	-0.0022	2.3778	0.0178
P2.S3.CA.HGS			2.4030	2.4062	0.0032	2.385	0.0180
P2.S1.UN.HGS		UN	2.3860	2.3852	-0.0008	2.3702	0.0158
P2.S2.UN.HGS			2.3680	2.3668	-0.0012	2.3518	0.0162
P2.S3.UN.HGS			2.3808	2.381	0.0002	2.365	0.0158
P2.S1.CCA.S263	8d Nail	CCA	2.0716	2.1078	0.0362	1.929	0.1426
P2.S2.CCA.S263			2.0928	2.0518	-0.0410	1.9228	0.1700
P2.S3.CCA.S263			2.0448	2.0846	0.0398	1.8944	0.1504
P2.S1.ACQ.S263		ACQ	2.0470	2.0554	0.0084	1.9144	0.1326
P2.S2.ACQ.S263			2.0464	2.058	0.0116	1.9124	0.1340
P2.S3.ACQ.S263			2.0666	2.0758	0.0092	1.9274	0.1392
P2.S1.CA.S263		CA	2.0820	2.106	0.0240	1.9386	0.1434
P2.S2.CA.S263			2.1018	2.1144	0.0126	1.9288	0.1730
P2.S3.CA.S263			2.0704	2.0806	0.0102	1.9184	0.1520
P2.S1.UN.S263		UN	2.0614	2.066	0.0046	1.9298	0.1316
P2.S2.UN.S263			2.0642	2.0708	0.0066	1.93	0.1342
P2.S3.UN.S263			2.0720	2.0918	0.0198	1.9122	0.1598
P2.S1.CCA.HGN	8d Nail	CCA	2.4070	2.4256	0.0186	2.2482	0.1588
P2.S2.CCA.HGN			2.9468	2.9682	0.0214	2.7694	0.1774
P2.S3.CCA.HGN			2.9392	2.9702	0.0310	2.7718	0.1674
P2.S1.ACQ.HGN		ACQ	2.9024	2.91	0.0076	2.7196	0.1828
P2.S2.ACQ.HGN			2.9362	2.952	0.0158	2.7584	0.1778
P2.S3.ACQ.HGN			2.9578	2.9618	0.0040	2.7646	0.1932
P2.S1.CA.HGN		CA	2.9484	2.9912	0.0428	2.7756	0.1728
P2.S2.CA.HGN			2.9280	2.9444	0.0164	2.7338	0.1942
P2.S3.CA.HGN			3.0198	3.0338	0.0140	2.8212	0.1986
P2.S1.UN.HGN		UN	2.9102	2.9216	0.0114	2.7484	0.1618
P2.S2.UN.HGN			3.0392	3.0488	0.0096	2.874	0.1652
P2.S3.UN.HGN			2.9300	2.9508	0.0208	2.7458	0.1842

Table B15 – Fastener 30-Day Retrieval Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
P2.S1.CCA.ZINCLAD	#8 Screw	CCA	0.16	0.1547	0.15285
P2.S2.CCA.ZINCLAD			0.163	0.1566	0.15475
P2.S3.CCA.ZINCLAD			0.161	0.1573	0.1547
P2.S1.ACQ.ZINCLAD		ACQ	0.155	0.15465	0.15095
P2.S2.ACQ.ZINCLAD			0.159	0.1571	0.1561
P2.S3.ACQ.ZINCLAD			0.16	0.15615	0.1525
P2.S1.CA.ZINCLAD		CA	0.159	0.162	0.1551
P1.S2.CA.ZINCLAD			0.155	0.1547	0.15195
P2.S3.CA.ZINCLAD			0.157	0.15535	0.1517
P2.S1.UN.ZINCLAD		UN	0.166	0.16655	0.1603
P2.S2.UN.ZINCLAD			0.157	0.1548	0.15185
P2.S3.UN.ZINCLAD			0.155	0.15425	0.15175
P2.S1.CCA.HGS	#8 Screw	CCA	N/A	0.16435	0.1642
P2.S2.CCA.HGS			N/A	0.1638	0.1636
P2.S3.CCA.HGS			N/A	0.16425	0.16455
P2.S1.ACQ.HGS		ACQ	N/A	0.1647	0.1648
P2.S2.ACQ.HGS			N/A	0.1648	0.1646
P2.S3.ACQ.HGS			N/A	0.16435	0.15735
P2.S1.CA.HGS		CA	N/A	0.16455	0.16465
P2.S2.CA.HGS			N/A	0.16325	0.164
P2.S3.CA.HGS			N/A	0.1646	0.1622
P2.S1.UN.HGS		UN	N/A	0.16455	0.16455
P2.S2.UN.HGS			N/A	0.16355	0.1637
P2.S3.UN.HGS			N/A	0.16445	0.16455
P2.S1.CCA.S263	8d Nail	CCA	0.112	0.11835	0.1072
P2.S2.CCA.S263			0.113	0.11155	0.10695
P2.S3.CCA.S263			0.111	0.1187	0.1072
P2.S1.ACQ.S263		ACQ	0.111	0.1161	0.1073
P2.S2.ACQ.S263			0.111	0.11415	0.1073
P2.S3.ACQ.S263			0.11	0.11165	0.10765
P2.S1.CA.S263		CA	0.112	0.11445	0.10735
P2.S2.CA.S263			0.111	0.11855	0.10705
P2.S3.CA.S263			0.112	0.11585	0.10735
P2.S1.UN.S263		UN	0.111	0.11355	0.10755
P2.S2.UN.S263			0.111	0.11525	0.10715
P2.S3.UN.S263			0.112	0.11775	0.1069
P2.S1.CCA.HGN	8d Nail	CCA	N/A	0.14415	0.13255
P2.S2.CCA.HGN			N/A	0.1379	0.13145
P2.S3.CCA.HGN			N/A	0.1434	0.1312
P2.S1.ACQ.HGN		ACQ	N/A	0.13765	0.13305
P2.S2.ACQ.HGN			N/A	0.13785	0.1312
P2.S3.ACQ.HGN			N/A	0.14025	0.1317
P2.S1.CA.HGN		CA	N/A	0.1455	0.13215
P2.S2.CA.HGN			N/A	0.13785	0.13245
P2.S3.CA.HGN			N/A	0.1378	0.1318
P2.S1.UN.HGN		UN	N/A	0.1414	0.13245
P2.S2.UN.HGN			N/A	0.1366	0.13135
P2.S3.UN.HGN			N/A	0.14665	0.13675

Table B16 – Un-Tested Fastener 30-Day Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Change After Clean (grams)
ZINCLAD 1	#8 Screw	CCA	2.5656	2.5662	0.0006	2.3442	0.2214
ZINCLAD 2			2.6372	2.6372	0.0000	2.3568	0.2804
ZINCLAD 3			2.5724	2.5724	0.0000	2.3662	0.2062
ZINCLAD 4		ACQ	2.6212	2.621	-0.0002	2.3974	0.2238
ZINCLAD 5			2.5822	2.5822	0.0000	2.3512	0.2310
ZINCLAD 6			2.6128	2.6124	-0.0004	2.3892	0.2236
ZINCLAD 7		CA	2.5048	2.5048	0.0000	2.3254	0.1794
ZINCLAD 8			2.6104	2.6098	-0.0006	2.3738	0.2366
ZINCLAD 9			2.5476	2.5474	-0.0002	2.3396	0.2080
ZINCLAD 10		UN	2.5720	2.5726	0.0006	2.3554	0.2166
ZINCLAD 11			2.6026	2.602	-0.0006	2.3748	0.2278
ZINCLAD 12			2.5486	2.5476	-0.0010	2.3172	0.2314
HGS 1	#8 Screw	CCA	2.3930	2.3928	-0.0002	2.3796	0.0134
HGS 2			2.3842	2.3838	-0.0004	2.3696	0.0146
HGS 3			2.4004	2.4004	0.0000	2.3838	0.0166
HGS 4		ACQ	2.3918	2.3914	-0.0004	2.3772	0.0146
HGS 5			2.4002	2.3996	-0.0006	2.3854	0.0148
HGS 6			2.3984	2.3982	-0.0002	2.3826	0.0158
HGS 7		CA	2.4018	2.401	-0.0008	2.386	0.0158
HGS 8			2.3698	2.369	-0.0008	2.354	0.0158
HGS 9			2.3852	2.3848	-0.0004	2.3696	0.0156
HGS 10		UN	2.3930	2.3928	-0.0002	2.38	0.0130
HGS 11			2.3902	2.3898	-0.0004	2.3748	0.0154
HGS 12			2.2846	2.2842	-0.0004	2.2662	0.0184
S263 1	8d Nail	CCA	2.0594	2.0592	-0.0002	1.9308	0.1286
S263 2			2.0870	2.087	0.0000	1.9246	0.1624
S263 3			2.0680	2.068	0.0000	1.9214	0.1466
S263 4		ACQ	2.0248	2.0248	0.0000	1.9088	0.1160
S263 5			2.0564	2.0566	0.0002	1.9138	0.1426
S263 6			2.0348	2.0346	-0.0002	1.9088	0.1260
S263 7		CA	2.0686	2.068	-0.0006	1.9296	0.1390
S263 8			2.0610	2.0606	-0.0004	1.9088	0.1522
S263 9			2.0518	2.0512	-0.0006	1.918	0.1338
S263 10		UN	2.0826	2.0822	-0.0004	1.9276	0.1550
S263 11			2.0820	2.0818	-0.0002	1.9254	0.1566
S263 12			2.0522	2.052	-0.0002	1.919	0.1332
HGN 1	8d Nail	CCA	3.0778	3.0766	-0.0012	2.8988	0.1790
HGN 2			2.9980	2.997	-0.0010	2.8412	0.1568
HGN 3			2.9348	2.934	-0.0008	2.7586	0.1762
HGN 4		ACQ	2.9936	2.9932	-0.0004	2.7916	0.2020
HGN 5			2.9308	2.9304	-0.0004	2.74	0.1908
HGN 6			2.8618	2.8612	-0.0006	2.727	0.1348
HGN 7		CA	3.0142	3.0136	-0.0006	2.8026	0.2116
HGN 8			2.9286	2.928	-0.0006	2.739	0.1896
HGN 9			3.0116	3.011	-0.0006	2.8414	0.1702
HGN 10		UN	2.9214	2.9202	-0.0012	2.7722	0.1492
HGN 11			3.0448	3.0436	-0.0012	2.876	0.1688
HGN 12			2.9188	2.918	-0.0008	2.7396	0.1792

Table B17 – Un-Tested Fastener 30-Day Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
ZINCLAD 1	#8 Screw	CCA	0.1656	0.16155	0.0041
ZINCLAD 2			0.1647	0.16055	0.0041
ZINCLAD 3			0.1573	0.15405	0.0033
ZINCLAD 4		ACQ	0.1517	0.15165	0.0000
ZINCLAD 5			0.1632	0.1603	0.0029
ZINCLAD 6			0.1608	0.1583	0.0025
ZINCLAD 7		CA	0.1626	0.15395	0.0086
ZINCLAD 8			0.1587	0.15675	0.0020
ZINCLAD 9			0.1589	0.15385	0.0050
ZINCLAD 10		UN	0.1559	0.15115	0.0048
ZINCLAD 11			0.1593	0.15675	0.0025
ZINCLAD 12			0.1531	0.148	0.0051
HGS 1	#8 Screw	CCA	0.1650	0.1638	N/A
HGS 2			0.1614	0.1644	N/A
HGS 3			0.1651	0.16245	N/A
HGS 4		ACQ	0.1648	0.16285	N/A
HGS 5			0.1655	0.16495	N/A
HGS 6			0.1646	0.16365	N/A
HGS 7		CA	0.1638	0.16525	N/A
HGS 8			0.1641	0.1645	N/A
HGS 9			0.1650	0.16485	N/A
HGS 10		UN	0.1649	0.16425	N/A
HGS 11			0.1654	0.1646	N/A
HGS 12			0.1640	0.1643	N/A
S263 1	8d Nail	CCA	0.1122	0.1075	0.0047
S263 2			0.1134	0.10705	0.0063
S263 3			0.1161	0.10715	0.0090
S263 4		ACQ	0.1136	0.10695	0.0067
S263 5			0.1126	0.10705	0.0055
S263 6			0.1133	0.1071	0.0062
S263 7		CA	0.1122	0.10705	0.0051
S263 8			0.1141	0.10715	0.0070
S263 9			0.1132	0.10715	0.0061
S263 10		UN	0.1128	0.1075	0.0053
S263 11			0.1124	0.1069	0.0055
S263 12			0.1126	0.107	0.0056
HGN 1	8d Nail	CCA	0.1361	0.13095	N/A
HGN 2			0.1346	0.13255	N/A
HGN 3			0.1360	0.13185	N/A
HGN 4		ACQ	0.1388	0.1311	N/A
HGN 5			0.1372	0.1311	N/A
HGN 6			0.1344	0.13185	N/A
HGN 7		CA	0.1373	0.1325	N/A
HGN 8			0.1381	0.13225	N/A
HGN 9			0.1382	0.131	N/A
HGN 10		UN	0.1358	0.13255	N/A
HGN 11			0.1387	0.132	N/A
HGN 12			0.1362	0.163095	N/A

Table B18 – Fastener 90-Day Retrieval Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Loss After Clean (grams)
P3.S1.CCA.ZINCLAD	#8 Screw	CCA	2.564	2.560	-0.004	2.311	0.253
P3.S2.CCA.ZINCLAD			2.603	2.635	0.032	2.305	0.298
P3.S3.CCA.ZINCLAD			2.632	2.590	-0.043	2.381	0.251
P3.S1.ACQ.ZINCLAD		ACQ	2.571	2.563	-0.007	2.320	0.251
P3.S2.ACQ.ZINCLAD			2.653	2.664	0.011	2.424	0.229
P3.S3.ACQ.ZINCLAD			2.535	2.536	0.002	2.304	0.230
P3.S1.CA.ZINCLAD		CA	2.611	2.579	-0.032	2.356	0.255
P3.S2.CA.ZINCLAD			2.623	2.585	-0.038	2.401	0.223
P3.S3.CA.ZINCLAD			2.532	2.542	0.010	2.290	0.243
P3.S1.UN.ZINCLAD		UN	2.579	2.580	0.001	2.342	0.237
P3.S2.UN.ZINCLAD			2.555	2.563	0.008	2.315	0.240
P3.S3.UN.ZINCLAD			2.590	2.614	0.024	2.359	0.232
P3.S1.CCA.HGS	#8 Screw	CCA	2.387	2.393	0.005	2.361	0.027
P3.S2.CCA.HGS			2.398	2.402	0.004	2.380	0.018
P3.S3.CCA.HGS			2.390	2.388	-0.001	2.362	0.028
P3.S1.ACQ.HGS		ACQ	2.387	2.365	-0.022	2.368	0.019
P3.S2.ACQ.HGS			2.387	2.380	-0.007	2.362	0.025
P3.S3.ACQ.HGS			2.420	2.418	-0.002	2.399	0.022
P3.S1.CA.HGS		CA	2.413	2.411	-0.002	2.391	0.022
P3.S2.CA.HGS			2.385	2.381	-0.004	2.360	0.024
P3.S3.CA.HGS			2.395	2.392	-0.003	2.371	0.024
P3.S1.UN.HGS		UN	2.378	2.377	-0.001	2.361	0.016
P3.S2.UN.HGS			2.388	2.386	-0.002	2.372	0.016
P3.S3.UN.HGS			2.387	2.386	-0.002	2.370	0.018
P3.S1.CCA.S263	8d Nail	CCA	2.064	2.063	-0.001	1.912	0.152
P3.S2.CCA.S263			2.098	2.088	-0.010	1.927	0.171
P3.S3.CCA.S263			2.044	2.037	-0.007	1.885	0.159
P3.S1.ACQ.S263		ACQ	2.062	2.071	0.009	1.925	0.136
P3.S2.ACQ.S263			2.068	2.073	0.005	1.933	0.135
P3.S3.ACQ.S263			2.057	2.059	0.002	1.924	0.133
P3.S1.CA.S263		CA	2.018	2.025	0.007	1.874	0.144
P3.S2.CA.S263			2.093	2.103	0.010	1.917	0.175
P3.S3.CA.S263			2.071	2.072	0.001	1.906	0.165
P3.S1.UN.S263		UN	2.105	2.110	0.004	1.954	0.151
P3.S2.UN.S263			2.068	2.060	-0.007	1.934	0.134
P3.S3.UN.S263			2.085	2.073	-0.013	1.923	0.162
P3.S1.CCA.HGN	8d Nail	CCA	3.054	3.078	0.024	2.901	0.152
P3.S2.CCA.HGN			2.947	2.950	0.003	2.760	0.187
P3.S3.CCA.HGN			3.027	3.020	-0.006	2.864	0.163
P3.S1.ACQ.HGN		ACQ	3.006	3.019	0.013	2.800	0.207
P3.S2.ACQ.HGN			3.026	3.042	0.016	2.837	0.188
P3.S3.ACQ.HGN			2.905	2.922	0.017	2.707	0.198
P3.S1.CA.HGN		CA	3.031	3.097	0.066	2.852	0.179
P3.S2.CA.HGN			2.918	2.936	0.019	2.722	0.196
P3.S3.CA.HGN			2.993	3.010	0.017	2.800	0.193
P3.S1.UN.HGN		UN	2.959	2.957	-0.002	2.791	0.168
P3.S2.UN.HGN			2.956	2.969	0.013	2.781	0.175
P3.S3.UN.HGN			2.897	2.912	0.015	2.712	0.185

Table B19 – Fastener 90-Day Retrieval Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
P2.S1.CCA.ZINCLAD	#8 Screw	CCA	0.156	0.151	0.005
P2.S2.CCA.ZINCLAD			0.160	0.158	0.002
P2.S3.CCA.ZINCLAD			0.160	0.152	0.008
P2.S1.ACQ.ZINCLAD		ACQ	0.160	0.153	0.007
P2.S2.ACQ.ZINCLAD			0.160	0.157	0.003
P2.S3.ACQ.ZINCLAD			0.160	0.153	0.007
P2.S1.CA.ZINCLAD		CA	0.161	0.159	0.002
P1.S2.CA.ZINCLAD			0.156	0.151	0.005
P2.S3.CA.ZINCLAD			0.157	0.153	0.004
P2.S1.UN.ZINCLAD		UN	0.159	0.150	0.009
P2.S2.UN.ZINCLAD			0.155	0.151	0.004
P2.S3.UN.ZINCLAD			0.155	0.152	0.003
P2.S1.CCA.HGS	#8 Screw	CCA	N/A	0.164	N/A
P2.S2.CCA.HGS			N/A	0.164	N/A
P2.S3.CCA.HGS			N/A	0.164	N/A
P2.S1.ACQ.HGS		ACQ	N/A	0.163	N/A
P2.S2.ACQ.HGS			N/A	0.163	N/A
P2.S3.ACQ.HGS			N/A	0.164	N/A
P2.S1.CA.HGS		CA	N/A	0.163	N/A
P2.S2.CA.HGS			N/A	0.164	N/A
P2.S3.CA.HGS			N/A	0.164	N/A
P2.S1.UN.HGS		UN	N/A	0.165	N/A
P2.S2.UN.HGS			N/A	0.164	N/A
P2.S3.UN.HGS			N/A	0.165	N/A
P2.S1.CCA.S263	8d Nail	CCA	0.113	0.107	0.006
P2.S2.CCA.S263			0.111	0.112	0.001
P2.S3.CCA.S263			0.112	0.107	0.005
P2.S1.ACQ.S263		ACQ	0.112	0.108	0.004
P2.S2.ACQ.S263			0.112	0.107	0.005
P2.S3.ACQ.S263			0.112	0.107	0.005
P2.S1.CA.S263		CA	0.113	0.107	0.006
P2.S2.CA.S263			0.113	0.108	0.005
P2.S3.CA.S263			0.112	0.109	0.003
P2.S1.UN.S263		UN	0.112	0.107	0.005
P2.S2.UN.S263			0.110	0.107	0.003
P2.S3.UN.S263			0.112	0.108	0.004
P2.S1.CCA.HGN	8d Nail	CCA	N/A	0.133	N/A
P2.S2.CCA.HGN			N/A	0.136	N/A
P2.S3.CCA.HGN			N/A	0.131	N/A
P2.S1.ACQ.HGN		ACQ	N/A	0.131	N/A
P2.S2.ACQ.HGN			N/A	0.132	N/A
P2.S3.ACQ.HGN			N/A	0.133	N/A
P2.S1.CA.HGN		CA	N/A	0.136	N/A
P2.S2.CA.HGN			N/A	0.132	N/A
P2.S3.CA.HGN			N/A	0.132	N/A
P2.S1.UN.HGN		UN	N/A	0.134	N/A
P2.S2.UN.HGN			N/A	0.132	N/A
P2.S3.UN.HGN			N/A	0.133	N/A

Table B20 – Un-Tested Fastener 90-Day Results – Weight Loss

Fastener Number	Fastener Type	Treated Wood	Initial Weight (grams)	Weight Before Clean (grams)	Weight Change (grams)	Weight After Clean (grams)	Weight Loss After Clean (grams)
ZINCLAD 1	#8 Screw	CCA	2.5656	2.5662	0.0006	2.330	0.236
ZINCLAD 2			2.6372	2.6372	0.0000	2.311	0.223
ZINCLAD 3			2.5724	2.5724	0.0000	2.322	0.233
ZINCLAD 4		ACQ	2.6212	2.621	-0.0002	2.371	0.230
ZINCLAD 5			2.5822	2.5822	0.0000	2.313	0.254
ZINCLAD 6			2.6128	2.6124	-0.0004	2.314	0.243
ZINCLAD 7		CA	2.5048	2.5048	0.0000	2.480	0.183
ZINCLAD 8			2.6104	2.6098	-0.0006	2.307	0.232
ZINCLAD 9			2.5476	2.5474	-0.0002	2.335	0.221
ZINCLAD 10		UN	2.5720	2.5726	0.0006	2.357	0.228
ZINCLAD 11			2.6026	2.602	-0.0006	2.423	0.231
ZINCLAD 12			2.5486	2.5476	-0.0010	2.343	0.226
HGS 1	#8 Screw	CCA	2.3930	2.3928	-0.0002	2.378	0.015
HGS 2			2.3842	2.3838	-0.0004	2.361	0.014
HGS 3			2.4004	2.4004	0.0000	2.360	0.016
HGS 4		ACQ	2.3918	2.3914	-0.0004	2.371	0.015
HGS 5			2.4002	2.3996	-0.0006	2.377	0.016
HGS 6			2.3984	2.3982	-0.0002	2.374	0.022
HGS 7		CA	2.4018	2.401	-0.0008	2.377	0.016
HGS 8			2.3698	2.369	-0.0008	2.384	0.014
HGS 9			2.3852	2.3848	-0.0004	2.378	0.021
HGS 10		UN	2.3930	2.3928	-0.0002	2.382	0.013
HGS 11			2.3902	2.3898	-0.0004	2.377	0.015
HGS 12			2.2846	2.2842	-0.0004	2.384	0.017
S263 1	8d Nail	CCA	2.0594	2.0592	-0.0002	1.921	0.128
S263 2			2.0870	2.087	0.0000	1.904	0.152
S263 3			2.0680	2.068	0.0000	1.901	0.148
S263 4		ACQ	2.0248	2.0248	0.0000	1.899	0.135
S263 5			2.0564	2.0566	0.0002	1.911	0.140
S263 6			2.0348	2.0346	-0.0002	1.924	0.133
S263 7		CA	2.0686	2.068	-0.0006	1.936	0.146
S263 8			2.0610	2.0606	-0.0004	1.902	0.134
S263 9			2.0518	2.0512	-0.0006	1.928	0.140
S263 10		UN	2.0826	2.0822	-0.0004	1.934	0.146
S263 11			2.0820	2.0818	-0.0002	1.913	0.158
S263 12			2.0522	2.052	-0.0002	1.926	0.139
HGN 1	8d Nail	CCA	3.0778	3.0766	-0.0012	2.758	0.187
HGN 2			2.9980	2.997	-0.0010	2.768	0.164
HGN 3			2.9348	2.934	-0.0008	2.800	0.172
HGN 4		ACQ	2.9936	2.9932	-0.0004	2.724	0.207
HGN 5			2.9308	2.9304	-0.0004	2.728	0.200
HGN 6			2.8618	2.8612	-0.0006	2.762	0.157
HGN 7		CA	3.0142	3.0136	-0.0006	2.711	0.210
HGN 8			2.9286	2.928	-0.0006	2.849	0.204
HGN 9			3.0116	3.011	-0.0006	2.773	0.186
HGN 10		UN	2.9214	2.9202	-0.0012	2.829	0.160
HGN 11			3.0448	3.0436	-0.0012	2.743	0.177
HGN 12			2.9188	2.918	-0.0008	2.803	0.190

Table B21 – Un-Tested Fastener 90-Day Results – Change in Diameter

Fastener Number	Fastener Type	Treated Wood	Initial Diameter (in)	Diameter After Clean (in)	Loss in Diameter (in)
ZINCLAD 1	#8 Screw	CCA	0.161	0.160	0.002
ZINCLAD 2			0.153	0.152	0.001
ZINCLAD 3			0.156	0.154	0.002
ZINCLAD 4		ACQ	0.165	0.161	0.004
ZINCLAD 5			0.156	0.156	0.000
ZINCLAD 6			0.160	0.155	0.005
ZINCLAD 7		CA	0.161	0.159	0.002
ZINCLAD 8			0.163	0.162	0.002
ZINCLAD 9			0.160	0.159	0.001
ZINCLAD 10		UN	0.160	0.156	0.004
ZINCLAD 11			0.161	0.158	0.003
ZINCLAD 12			0.161	0.157	0.004
HGS 1	#8 Screw	CCA	N/A	0.165	N/A
HGS 2			N/A	0.165	N/A
HGS 3			N/A	0.164	N/A
HGS 4		ACQ	N/A	0.164	N/A
HGS 5			N/A	0.164	N/A
HGS 6			N/A	0.165	N/A
HGS 7		CA	N/A	0.162	N/A
HGS 8			N/A	0.165	N/A
HGS 9			N/A	0.164	N/A
HGS 10		UN	N/A	0.165	N/A
HGS 11			N/A	0.166	N/A
HGS 12			N/A	0.164	N/A
S263 1	8d Nail	CCA	0.111	0.111	0.000
S263 2			0.112	0.111	0.001
S263 3			0.112	0.111	0.001
S263 4		ACQ	0.110	0.109	0.001
S263 5			0.110	0.108	0.002
S263 6			0.110	0.109	0.001
S263 7		CA	0.112	0.111	0.001
S263 8			0.111	0.110	0.001
S263 9			0.111	0.110	0.001
S263 10		UN	0.111	0.110	0.001
S263 11			0.111	0.111	.000
S263 12			0.112	0.110	-.002
HGN 1	8d Nail	CCA	N/A	0.140	N/A
HGN 2			N/A	0.137	N/A
HGN 3			N/A	0.140	N/A
HGN 4		ACQ	N/A	0.135	N/A
HGN 5			N/A	0.139	N/A
HGN 6			N/A	0.138	N/A
HGN 7		CA	N/A	0.141	N/A
HGN 8			N/A	0.135	N/A
HGN 9			N/A	0.138	N/A
HGN 10		UN	N/A	0.138	N/A
HGN 11			N/A	0.142	N/A
HGN 12			N/A	0.137	N/A



American Iron and Steel Institute

1140 Connecticut Avenue, NW
Suite 705
Washington, DC 20036
www.steel.org



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